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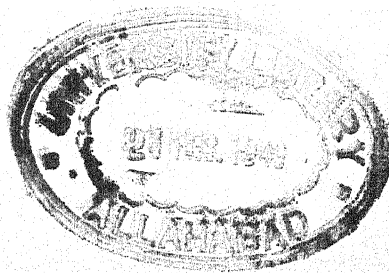
July, 1943

HEPATICAЕ OF NORTH AMERICA

PART II

*By*

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## FOREWORD

Our chief concern is to write a book useful to workers in the Hepaticae. Our difficulties are several: (a) The inadequate observations of morphology important in grouping the species and genera. The origin of the branches and the structure of seta, capsule, stem and perianth, are among the best criteria in determining relationships of groups of genera, and sometimes of species; but in the comparison of species these prove to be remarkably unknown. (b) Lack of illustrations, undoubtedly due largely to cost. (c) Lack of literature and of the funds with which to buy it. (d) Lack of comparisons of the plants. (e) Lack of American specimens of numerous species for examination.

Here we should acknowledge the generous cooperation of Miss Margaret Fulford in sending us material from the Sullivant Hepatic Herbarium, and of Dr. Evans and others for permitting us to examine critical material.

The original drawings throughout the work were largely made by Miss Elizabeth Curtis, M.F.A., University of Washington; Dr. Helen M. Gilkey, now in charge of the herbarium of the Oregon State College; and Elsie K. Waddingham, a former student. Those illustrations selected from other works were largely redrawn by the Misses Hildegard Berg, Bethel Welch, Beatrice and Harriet Rudolph, Patricia Longmire, Sylvia Edmonds, Dorothy Dahlstrom, and several others.

Of great help in the preparation of the manuscript were Mrs. Elizabeth Young and the Misses Jean Boyle, Mary Bakun, Audrey Clarkson, Betty Winningham, Nellie Wasson, and others. The National Youth Administration supplied persons for routine and mechanical work, thus saving the authors a great deal of time.

The manuscript of the body of the work is completed except for the *Lejeunea* complex and the Anthocerotales. The time of issue will unfortunately depend somewhat upon the demands of other publications on the time of the printer.

The provisional numbered list of references accompanying the first 161 pages published in 1937 has been very largely increased, but it is not thought wise to print a new one until the work is completed. The old list contains two serious errors: (a) No. 143 should be No. 301, and Nos. 144-301 inclusive should therefore be one number lower. (b) No. 507 should be No. 477, and Nos. 477-506 inclusive should therefore be one number higher.

In the descriptions of species, exact figures of size and often of number should not be taken too seriously. Plants are living things, able to

adapt themselves to various conditions. They are variable in size and in the size of their organs, as well as in the cells which compose the organs. "Plant very small" is too vague to give every one the same idea. "Plant 0.5-1.5 cm tall" conveys the same idea to all but is too exact. Some one may find a plant 2 cm tall, which is still the same species but an exceptionally tall individual. When figures are interpreted with good sense they convey the idea better than do vague phrases.

We believe that comparisons are better than descriptions in the study of species, but too costly to print very copiously. If one chooses perhaps 100 points for observation, points believed likely to show differences between species, and records what has been observed for each species (such as is illustrated by the small comparison following the description of the genus *Plectocolea*) the number of gaps found is appalling. This type of comparison raises so many questions that it is not only keenly stimulating, but, in our experience, is the best guide for the study of materials. Try it. You will probably find 100 points insufficient. Our keys are usually a few simple points chosen from such comparisons.

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## Hepaticae of North America

### PART II

#### JUNGERMANNIACEAE<sup>1</sup>

Plants leafy. Stem without xylem or phloem, simple or branched, growing by apical cell; apical cell a triangular pyramid (except *Pleurozia*). Rhizoids probably always present somewhere in the life history but not known in all species, nearly always unbranched, 1-celled, without peg-like thickenings. Leaves nearly always in two lateral rows, and commonly one ventral row which constitutes the underleaves; lateral leaves usually alternate, rarely opposite, sessile, transversely to succubously or incubously inserted, in a very few almost or quite longitudinally inserted, without vein but in a few genera (e.g., *Herberta*, *Diplophyllum*) with a well-defined group of longer cells in the median region. Cells of the leaves usually nearly isodiametric, rarely up to several times as long as wide. Gemmae present or wanting, most commonly formed on the tips of young leaves. Underleaves from wanting to as large as the leaves, constituting a third row on the ventral side. Plants bisexual or unisexual.<sup>2</sup> Antheridia nearly always in the axils of male bracts which are lateral leaves or modified ones, in a few species also in the axils of underleaves or on the stem outside the axils. Perianth present in nearly all, originating through the union of two upper leaves and commonly the upper underleaf. Archegonia at the end of the stem, involving the apical cell in their formation except in *Haplomitrium*, either on the main stem or a normal branch, or on a specialized short branch. Sporophyte of one sporangium with a stalk and foot; sporangium opening by 2-4 or more valves, its wall 1-8 layers thick. Spiral elaters present.

The family Jungermanniaceae is a large one, almost as large as the Compositae. Most writers split the group into 9 to 17 smaller groups

<sup>1</sup> yung' er man nī ā' sē ē.

<sup>2</sup> We use unisexual and bisexual to indicate whether the same *gametophyte* bears one kind of sex organs or both kinds. The words dioecious and monoecious, or dioicous and monoicous, were first used to indicate whether the same sporophyte, or the same flower on the sporophyte, gives rise to thalli bearing one kind of sex organ or two kinds. The sporophyte of *Selaginella* is monoecious but the gametophytes are unisexual. The sporophyte of *Ginkgo* is dioecious and the gametophytes are likewise unisexual.

and call those families. These smaller groups are rather poorly defined, some of them less clearly so, in fact, than the subfamilies of the Compositae, Rosaceae and Liliaceae. Families should be clearly defined. Further, families should be groups of genera closely related phylogenetically. At present, relationships among leafy hepaticae are evaluated too much by resemblances between vegetative parts. Botanists working on the comparative morphology of the liverworts do not agree among themselves as to genetic relationships between the genera; this is almost a sure sign of insufficient evidence. The doubts are due chiefly to two facts: (a) the tropical liverworts are rather largely unknown, and what is known of them needs to be brought together in concise form; (b) even in European and North American liverworts the detailed morphology, especially of the sporophyte, reproductive organs and stem, is still so strikingly unknown that we have not the facts upon which to base a phylogenetic arrangement which is likely to withstand the test of time. This is especially true of the lower genera with leaves transversely or subcubously inserted. For these reasons we give the groups the tribal ending "oideae," following Macvicar. The descriptions of these tribes are written for North American and European species. We do not presume to speak for the wealth of tropical material.<sup>3</sup>

<sup>3</sup>In these remarks after descriptions it is not intended to criticise work done on the hepaticae, even though pointing out what has been done and what has not been done is likely to sound so. We wish to stimulate research in the liverworts. One of the best ways of doing that is to point out what needs to be done. It does not follow that those who did what has been done should also have done what has not been done. Most of the criticism of scientific work comes from those who have done little of it.



## ARTIFICIAL KEY TO THE TRIBES OR GENERA\*

- A. Leaves opposite.  
 B. Leaves entire, unlobed, bordered by a single row of larger cells with thicker walls ..... *Arnellia*, p. 265  
 BB. Leaves somewhat toothed or lobed, not bordered ..... *Lophocolea*, p. 250  
 AA. Leaves alternate.  
 C. Leaves with about  $\frac{1}{2}$  or more of the area composed of filaments or cilia.  
 D. The primary 2-5 lobes of the leaves again divided into cilia. *Ptilidioideae*, p. 173  
 DD. The primary 2-4 lobes of the leaves not again divided.  
 E. Underleaves nearly as long as adjacent leaves ..... *Blepharostoma*, p. 190  
 EE. Underleaves about  $\frac{1}{2}$  as long as the leaves or less. *Lepidozioideae*,† p. 337  
 CC. Leaves with distinctly less than  $\frac{1}{2}$  the area composed of filaments or cilia.
- F. Leaves complicately 2-lobed, in most species sharply so but in some only semi-cylindrically so.  
 G. Dorsal lobe of leaf smaller than the ventral one but in some species the two nearly equal.  
 H. Lobes of leaves ending each in a long cilium, otherwise entire. *Nowellia*, p. 504  
 HH. Lobes of leaves not ending in a cilium, or if so the margin not entire.  
 I. Lobes of leaves sharply and coarsely dentate, acute, nearly equal. *Prionolobus*, p. 556  
 II. Lobes of the leaves not as above ..... *Scapanioideae*, p.  
 GG. Dorsal lobe of leaf larger than the ventral one but in some species the two nearly equal.  
 J. Underleaves present throughout or very common.  
 K. Ventral lobe of leaf neither saccate nor inflated, without narrow stalk-like base; underleaves unlobed; plants green to brown, large; elaters free from the valves, not thicker at one end ..... *Porella*, p.  
 KK. Ventral lobe of leaf in most species saccate or inflated; underleaves unlobed or 2-lobed; plants green to red, sometimes blackish or brownish, rather small; elaters remaining attached to the valves in dehiscence, plainly trumpet-shaped.  
 L. Ventral lobe of leaf in nearly all species a helmet-shaped sac attached by a narrow stalk-like base; leaf from which a branch arises without a ventral lobe; elaters 20-36 per valve; seta 8-9 cells thick, or if only 4 cells thick (*Jubula*) the leaf lobes conspicuously spinose-dentate ..... *Frullanioideae*, p.  
 LL. Ventral lobe of leaf commonly inflated when well developed, but not helmet-shaped, not narrowed to a stalk-like base but commonly with rather wide attachment to the stem; leaf from which a branch arises with a ventral lobe; elaters 6-7 per valve; seta in cross section composed of 4 cells ..... *Lejeunoideae*, p.

\* In this key, unless otherwise indicated, the characters are those of normal sterile stems. If a key considered all the abnormalities, it would become so involved as to defeat its purpose. Darkness, humidity and submergence greatly affect plants. Potatoes growing in a cellar are still the same *Solanum tuberosum* although the specific description would not fit the plants very well. In most species the leaves and underleaves grade more or less into the final involucre whorl immediately below the perianth, although underleaves are often wanting. It is this final whorl only which we consider constituted of two female bracts and often a female bracteole. The leaves below it are often abnormal, and therefore a female branch is not as reliable as a sterile one for purposes of key characters. Male branches are commonly less modified than the female ones, but in many species are very different from the sterile shoots, and thus not good for leaf and underleaf characters. In most species some or all of the branches are like the stems, and there is no need to discriminate when studying leaf and underleaf characters. In a considerable number of species, however, branches occur with the leaves smaller or even wholly wanting, or sometimes modified through the formation of gemmae; for these reasons leaves and underleaves of the stem rather than of the branches are suggested for key characters. The basal leaves of a shoot are often juvenile in form; the apical ones juvenile in development, and thus always with thin cell walls and without trigones. For cell walls and trigones choose the middle of the leaf or the middle of the lobe when deeply lobed; when the lobes are very unequal consider the cells of the middle of the larger lobe (or half) of the leaf as the normal, with few exceptions (as for example *Herberta*). This is a key to the species of our area only.

† Those tribes or genera which come in future parts cannot now have the page numbers inserted. The reader may insert them in his own copy as future parts appear.



JJ. Underleaves wanting or scarce.

M. Dorsal lobe of leaf again 2-lobed at tip and these secondary lobes closely spinose-dentate; both margins of the ventral lobe free and involute to form a sac. .... *Pleurozia*, p.

MM. Dorsal lobe of leaf not again 2-lobed.

N. Leaves incubous.

O. Both margins of the ventral lobe of the leaf free; ventral lobe not inflated; rhizoids on the ventral lobes of the leaves; elaters free, not thicker at one end. .... *Radula*, p.

OO. Only one margin of the ventral lobe of the leaf free; ventral lobe often inflated when well developed; rhizoids on the stem; elaters remaining attached to the valves in dehiscence, plainly trumpet-shaped. .... *Lejeunioideae*, p.

NN. Leaves succubous; both margins of the ventral lobe of the leaf free; ventral lobe not inflated; the 2 lobes not greatly unlike in size. .... *Lophozia*, p. 340

FF. Leaves not complicately 2-lobed.

P. Underleaves similar to the leaves, common to present throughout, about  $\frac{1}{2}$  as long as the leaves or longer.

Q. Leaves or underleaves or both dentate to spinose-dentate or ciliate in addition to the 2-5 primary lobes.

R. Lobes of the leaves and of the underleaves mostly ending as a cilium.

*Ptilidium*, p. 195

RR. Lobes of the leaves and of the underleaves not ending as a cilium.

*Tennoma*, p. 413

QQ. Leaves and underleaves entire except for the 2-6 primary lobes.

S. Leaves all 2-lobed. .... *Ptilidioideae*, p. 173

SS. Leaves mostly unlobed or more than 2-lobed.

T. Sinuses not over  $\frac{1}{6}$  the leaf length. .... *Haplomitrium*, p. 171

TT. Sinuses about  $\frac{1}{2}$  the leaf length or deeper. .... *Lophozia*, p. 340

PP. Underleaves either not similar to the leaves or else less than half as long, or scarce to rudimentary or wanting.

U. Leaves distinctly incubous.

V. Leaves with apex about equally 2-lobed or 2-toothed or if unindented the apex obtuse to rounded; leaves often decurrent; rhizoids from bases of underleaves; perianth wanting; perigynium large, rhizoidous.

*Calypogeia*, p.

VV. Leaves with apex rarely 2-lobed or 2-toothed, when unindented the apex acute; leaves not decurrent; rhizoids from bases of flagelliform branches or from female bracts; perianth present; perigynium wanting. .... *Bazzania*, p.

UU. Leaves nearly transverse to distinctly succubous.

W. Leaves predominantly 3-5-lobed.

X. Female bracteole present; leaves entire except for the lobing.

*Lophozioideae*, p. 337

XX. Female bracteole wanting; leaves in nearly all species somewhat toothed in addition to the lobing. .... *Plagiochila*, p. 433

WW. Leaves predominantly 2-lobed. (See also WWW.)

Y. Underleaves on normal stems wanting to scarce, or present only near tip, or rudimentary and thus difficult to find.

Z. Leaves nearly or quite transversely inserted (less than 30° succubous).

a. Each lobe of the leaf composed mostly of a long incurved cilium; sinus rounded and descending about  $\frac{1}{2}$  the leaf length.

*Nowellia*, p. 504

aa. Lobes of leaves not as above; sinus often angular.

b. Perianth wanting; in most species the shoots with very closely appressed leaves, club-shaped, often whitish.

*Marsupelloideae*, p. 206

bb. Perianth present; in nearly all species the shoots without closely appressed leaves and not or hardly club-shaped, rarely whitish.

c. Perianth thick and fleshy, adnate to the female bracts and bracteole ..... *Marsupella*, p. 217

cc. Perianth not thick and fleshy, free from the female bracts and bracteole.

d. Seta composed of 4 rows of cells; plants small and delicate; leaves 2-lobed, the lobes not greatly unequal.

*Cephalozioelloideae*, p. 507

dd. Seta in cross section of 8 or more cells; plants mostly moderately large and not very delicate; in many species some of the leaves unlobed or more than 2-lobed, the lobes sometimes greatly unequal.

e. Branches arising laterally; plants but little branched except close to the perianth..... *Lophozioideae*, p. 337

ee. Branches arising ventrally; plants commonly with several branches other than subfloral ones.

*Cephalozia*, p. 477

ZZ. Leaves distinctly succubously inserted (30° or more).

f. Leaves when mature with marginal rhizoids... *Acrobolbus*, p. 399

ff. Leaves without marginal rhizoids.

g. Rhizoids in tufts..... *Cephalozia*, p. 417

gg. Rhizoids scattered or too few to show tufting.

h. Perigynium present, rhizoidous; shoots often with some leaves hardly indented at apex; sinus rounded or crescentic, descending  $\frac{1}{4}$  or less of the leaf length. *Nardia*, p. 306

hh. Perigynium wanting; on normal shoots all leaves more or less indented at tip.

i. Nearly all the leaf sinuses descending  $\frac{1}{10}$ - $\frac{1}{6}$  the leaf length but in occasional leaves more deeply; trigones large.

*Lophozioideae*, p. 337

ii. Nearly all the leaf sinuses descending  $\frac{1}{6}$ - $\frac{1}{2}$  the leaf length but in occasional leaves less deeply; trigones various.

j. Seta composed of 4 rows of cells; plants small.

*Cephalozioelloideae*, p. 507

jj. Seta in cross section composed of 16 or more cells; plants mostly moderately large and not very delicate.\*

*Lophozioideae*, p. 337

\* Here, also, may be sought *Plagiochila tridentata* and *P. austini*, both of which are very unlike the usual *Plagiochila*, and in both of which the female inflorescence and sporophyte are unknown.

YY. Underleaves on normal stems present throughout or common even below the last few leaves of the stem tip, not rudimentary.

k. Many of the underleaves connate with the leaves.....*Nardia*, p. 306

kk. Underleaves free from the leaves.

l. Underleaves divided  $\frac{1}{2}$  or more into 2 subulate lobes, with or without additional marginal lobes or teeth.

m. Underleaves purplish violet; rhizoids brownish violet; leaf sinus descending  $\frac{1}{10}$  or less of the leaf length.

*Mesoptychia*, p. 305

mm. Underleaves white to green; rhizoids white; leaf sinus descending  $\frac{1}{8}$ - $\frac{1}{6}$  the leaf length.

n. Underleaves present throughout; leaves longer than wide; margins in some species dentate in addition to the lobing. ....*Lophocolea*, p. 256

nn. Underleaves not present throughout but common; leaves as wide as or wider than long, margin entire except for the lobing. ....*Orthocaulis*, p. 401

ll. Underleaves divided  $\frac{3}{4}$  or less and the lobes not subulate and only in occasional species with marginal teeth.

o. Branches common, lateral, replacing the ventral half of the leaf; underleaves  $\frac{1}{3}$ - $\frac{1}{2}$  the area of the leaves, present throughout, unlobed but often with a tooth on one side near base. ....*Pleuroclada*, p. 187

oo. Branches ventral or lateral, but when lateral not replacing the ventral half of the leaf; underleaves smaller or 2-lobed.

p. Perigynium well developed or merely a fleshy modified branch; all leaves 2-lobed; rhizoids in tufts; seta 4 or more cells thick. ....*Harpanthoideae*, p. 456

pp. Perigynium wholly wanting; in many species the leaves near the perianth with more than 2 lobes; rhizoids not in tufts except in *Cladopodiella*.

q. Seta of 4 rows of cells; plants small, delicate.

*Cephalozelloideae*, p. 507

qq. Seta 4 or more cells thick.

r. Branches few or none; female bracts and bracteole all free; perianth with a tubular beak except in *L. rutheana*. ....*Leiocolea*, p. 379

rr. Branches common; female bracts connate at base but bracteole free; perianth without beak.

*Cladopodiella*, p. 506

WWW. Leaves predominantly unlobed.

s. Leaf margin more or less dentate except in *P. arctica* in which the leaves are entire, circular and but little succubous.

*Plagiochila*, p. 433

ss. Leaf margin entire to sinuate or crenulate.

t. Underleaves present throughout and easily seen; branches arising behind the ventral half of a leaf or between a leaf and underleaf; rhizoids in tufts. ....*Lophocoleoideae*, p. 235

tt. Underleaves not present throughout, wanting to common; branches from a leaf axil or ventral; rhizoids not in tufts except in *Mylia*.

u. Underleaves wanting to scarce or present only near tip of shoot; branches lateral. ....*Nardioideae*, p. 267

uu. Underleaves common but sometimes hard to find.

v. Branches lateral; female inflorescence on main shoot; leaves transverse to slightly succubous ( $30^\circ$  or less).

*Nardioideae*, p. 267

vv. Branches mostly ventral but some lateral branches occurring; female inflorescence on short modified ventral branch; leaves distinctly succubous ( $30^\circ$  or more).

*Odontoschisma*, p. 464

Not enough is known about the morphology of the leafy hepaticae to make a diagram of phylogenetic relationships which will stand the test of time, unless it be by accident. However, some idea of relationship, with the reasons for it, is better than none. Nearly all concepts of phylogeny among liverworts have good points when the reasons are clearly stated. Our arrangement of groups is based upon the following concepts:

(1) The liverworts and ferns had a common ancestor as evidenced by the structure of their antheridia, archegonia and sperms.

(2) This hypothetical hepatopterid ancestor probably was more like the liverworts than like the ferns, since such a concept would not involve the hypothetical degeneration of root, vascular bundle and sporophytic leaf.

(3) The thalloid hepaticae preceded the leafy ones. Here might be mentioned that:

(a) The more simple gametophytes go with the lesser specialization in the tissue of the sporophyte.

(b) By far the most successful hepaticae are the leafy ones. Successful groups usually arise from the less successful by adapting themselves to the habitat. No great group is derived from a successful group by unfitting itself for the conditions in which it must live.

(c) The discovery of remains of ferns in geological strata older than those in which remains of hepaticae are known, cannot be considered a very strong argument. Hepaticae have soft bodies while ferns have firm parts and thus would be much more likely to be preserved. If we knew no more of the geological record of vertebrates than we know of hepaticae it would be possible to present many arguments in favor of an hypothesis that fish are degenerations of the human race.

In general the reproductive structures are a better guide to relationship than are vegetative ones. This is a principle long recognized in seed plants. Among the chief criteria for determining phylogeny among leafy liverworts may be mentioned the following, of which some are more important in one group and others in another:

1. The female inflorescence on the main stem, on a leafy branch, or constituting all of a very short branch.
2. The occurrence of antheridia in the axils of bracts only, or also elsewhere.
3. Seta in cross section composed of cells all similar or the cortical ones different from the interior ones in size or thickness of wall or both.
4. Seta many or few cells thick, and the relative size of the interior and cortical cells.



5. The number of archegonia in a group.
6. Specialized dorsal antheridial lobules.
7. The form of the perianth with regard to ridges and compression.
8. The structure of the wall of the sporangium.
9. Incubous, succubous or transverse direction of leaf insertion.
10. The origin of the branches.
11. The structure of the stem.
12. The attachment of the elaters.
13. The dorsal or the ventral half of a leaf, or what is homologous with it, the larger.
14. The simple bilobing of the leaf.
15. The folding of one lobe of a leaf upon the other, that is, complicate bilobing.

Of the above, 3, 4, 8, and 11 are so extensively unknown that they can be used only here and there as phylogenetic criteria. Here are four of the best dozen guides to ancestry largely useless through ignorance. That constitutes roughly  $\frac{1}{3}$ – $\frac{1}{5}$  of the evidence. This may make it clear why the evidence is not yet conclusive, especially of the more primitive half of the genera of leafy hepaticae.

#### HAPLOMITRIOIDEAE<sup>4</sup>

Stems erect or nearly so, giving rise from near base to rhizomatous branches whose ends may continue into leafy erect plants; rhizomes creeping, fleshy, branched, leafless and bractless. Rhizoids wanting. Leaves irregularly alternate but often very nearly in whorls of 3, transversely inserted to somewhat incubous, the 3 rows alike, not lobed. Leaf cells with thin walls; trigones wanting. Plants unisexual. Male inflorescence near the tips of ordinary leafy branches in the axils of bracts and outside them on the surface of the stem (*Haplomitrium*), or on the flattened bractless tip of the stem (*Calobryum*). Female inflorescence terminal; archegonia stopping growth of the stem, in *Calobryum* by involving the apical cell in their formation, in *Haplomitrium* without directly involving it. Perianth wanting. Elaters with 2 spirals. Sporangium longly cylindric, incompletely 4-valved, sometimes opening by a single slit; the wall of 1 layer of cells except at the apex, with longitudinal annular thickenings.

In general those groups of leafy liverworts with leaves transversely or succubously inserted seem to us to be the lowest, that is, nearest the thalloid hepaticae. Among the lowest of these we would place the Haplomitrioideae since, in *Haplomitrium*, the apical cell is not involved in the formation of archegonia although its growth ceases with it.

<sup>4</sup> háp" lô mít" rí ôi' dē ē.

**HAPLOMITRIUM**<sup>5</sup> Nees Naturg. Eur. Leberm. 1:109, 1833.

- Jungermannia* L., of Sowerby Eng. Bot., pl. 2555, 1813, in part.  
*Scalius* S. F. Gray Nat. Arr. Brit. Pl. 1:704, 1821. Not *Scalia* Sims, Bot. Mag., pl. 956, 1806, a genus in the Compositae, now the genus *Podolepus*.  
*Mniopsis* Dum. Comm. Bot. 114, 1822. Not of Mart. Nov. Gen. et Sp. 1:3, pl. 1, 1822, a genus of the Podostemonaceae of the seed plants.  
*Lejeunia* Spreng. Syst. Veg. 4:234, 1827. Not *Lejeunea* Libert, Ann. Gen. Sci. Phys. 6:372, 1820.  
*Gymnomitrium* Corda, Opiz, Beitr. 651, 1828, in part.  
*Scaliusa* Kuntze Rev. Gen. Pl., 1891, according to Warnstorf (523).

Stem erect, it and the rhizome thick and fleshy. Rhizoids wanting on both stem and rhizome. Leaves irregularly alternate, sometimes almost in whorls of 3, in 3 indistinct and very similar rows, at least those on the lower part of the stem somewhat incubous, mostly transverse, 2-3-lobed; lobes mostly unequal, the middle one the largest. Cells of the leaf thin walled; trigones wanting. Underleaves represented by one of the 3 rows of leaves. Antheridia not restricted to the axils of the male bracts, also occurring scattered on the stem in the region of the bracts. Female bracts smaller than the leaves. Perianth wanting; archegonia in the axils of the female bracts, solitary, naked. Sporangium oblong to cylindric, its wall of 1 layer of rectangular cells each with one longitudinal annular thickening. Name from Gk. *aploos*,<sup>6</sup> simple, and *mitrion*, a little cap; in reference to the calyptra without a perianth around it. There is only one species.

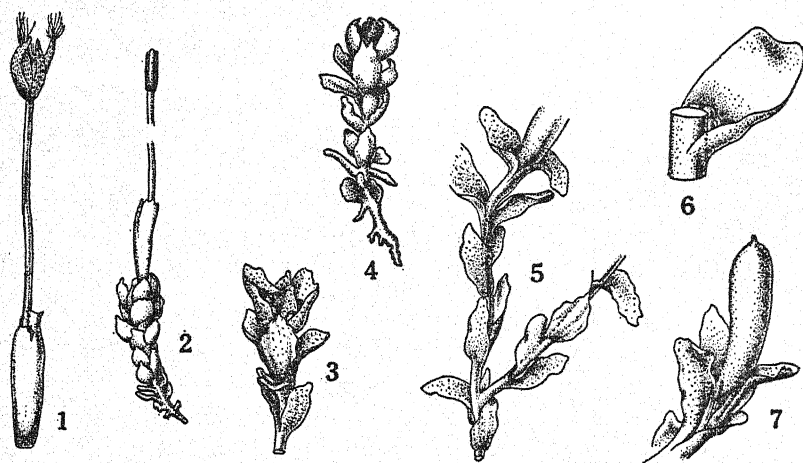
1. *Haplomitrium hookeri*<sup>7</sup> (Sm.) Nees Naturg. Eur. Leberm. 1:111, 1833.

- Jungermannia hookeri* Sm., in Sowerby Engl. Bot., pl. 2555, 1813.  
*Scalius hookeri* S. F. Gray Nat. Arr. Brit. Pl. 1:705, 1821.  
*Mniopsis hookeri* Dum. Comm. Bot. 114, 1822.  
*Lejeunia hookeri* Spreng. Syst. Veg. 4: 234, 1827.  
*Gymnomitrium hookeri* Corda, Opiz, Beitr. 651, 1828.  
*Mniopsis acutifolia* Dum. Syll. Jung. Eur. 75, 1831.  
*H. cordae* Nees Naturg. Eur. Leberm. 1:112, 1833.  
*Scalia hookeri* Lindb. Musci Scand. 10, 1879.

Plants scattered or in small loose tufts, pale green, in drying dark green and shrinking. Stems 2-9 mm long, erect, from rhizomatous base 3-7 mm long, little or usually not branched, thick, fleshy, slightly flattened dorsally; in cross section about 16 cells thick, of large cells, the epidermal layer smaller than the others; rhizome likewise fleshy, whitish to light brown, giving rise to new stems. Rhizoids wanting. Leaves alternate, rather indefinitely in 3 rows, two homologous with the leaves of other leafy hepaticae and one homologous with the underleaves, but in the absence of rhizoids the under row is indistinguishable from the lateral

<sup>5</sup> háp lô mít' rí ūm.<sup>6</sup> Throughout the work the derivations have been referred to the Department of Classical Languages of the University of Washington. The authors, however, assume the responsibility for errors, since the language specialists are not botanists.<sup>7</sup> hōōk' ēr i.

ones; the leaves on the lower part of the stem somewhat incubously inserted and much the smaller; the upper leaves transverse, not decurrent, distant below, imbricate above, erect-spreading to recurved, often with tip bent toward the stem, commonly 2-3-lobed, oblong-ovate or obovate to lingulate on the same plant, concave; margin entire except for apical lobes, or irregularly and obtusely toothed; lobes mostly unequal; sinuses crescentic. Cells of the leaf middle  $25-45\ \mu$ , of the apex  $27-38\ \mu$ , of the base  $56-63\ \mu$ , polygonal, densely chlorophyllose; walls thin; trigones wanting. Gemmae unknown. Underleaves transversely inserted, not distinguishable from the leaves. Plants unisexual. Male plants rather small-



*Haplomitrium hookeri*. 1, Perianth and open sporangium,  $\times$  about 4. 2, Plant with sporophyte,  $\times$  2.6. 3, Upper portion of male plant with antheridia,  $\times$  about 5. 4, Male plant with antheridia at tip barely visible,  $\times$  5.3. 5, Portion of female plant,  $\times$  about 5. 6, Male bract with antheridia,  $\times$  about 21. 7, Tip of female plant with perianth,  $\times$  about 8. (1, 3, 6, 7, after Hooker; 2, 4, after K. Mueller; 5, after Pearson.)

er, usually in smaller tufts; male bracts along the upper portion of the stem, erect when young, more or less spreading at maturity, much like the leaves, often with a few papillae on margin; antheridia irregularly scattered on the stem among the bracts, also 2-3 in the axil of each of the bracts, of which one-third represent the male bracteoles, about  $260\ \mu$  long and  $200\ \mu$  wide, broadly oval, pale orange, with a stalk about as long as the body. Female inflorescence at the tip of the stem; female bracts much smaller than the leaves, narrow, lingulate, entire or little toothed, none of them united into a perianth; archegonia solitary in the axils of the female bracts, naked; calyptra about 3 mm long and  $500\ \mu$  wide, oblong-linear,  $\frac{2}{3}-\frac{4}{5}$ -emergent, its wall of several layers of cells.

Seta 0.6-3 cm long. Sporangium cylindric or oblong, 1.5-2 mm long, 500-750  $\mu$  thick, pale brown, commonly dehiscing along only one intervalvular line; valves 2-4, rounded at tip, extending to base; wall only 1 cell thick. Elaters 400-500  $\mu$  long, about 10  $\mu$  thick, narrowed at both ends; spirals normally 2, loosely wound, light brown; basal elaters attached, short, clavate, with only 1 loosely wound spiral; apical elaters attached to valves but normal. Spores 23-28  $\mu$ , densely verruculose, darkly greenish brown, spherical to oblong. Named in honor of W. J. Hooker, a noted English bryologist.—On moist sandy or peaty soil; subarctic or alpine.

ILLUSTRATIONS: Gottsche, *Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur.* 20: pls. 13-16, 1843; Hooker (285) pl. 54; Pearson (433) 2: pl. 189; K. Mueller (409) 1: fig. 227; Sowerby, *Eng. Bot.*, pl. 2555, 1813; Ekart (124) pl. 8, fig. 65; Warnstorff (523) 141, fig. 1; Carrington, *Brit. Hep.*, pl. 1, fig. 1, 1874; Jensen (323.5) 59, 3 figs.; Leitgeb, *Unters. Leberm.* 2: pl. 12, 1875; Macvicar (374) 90, figs. 1-8; Dumortier, *Hep. Eur.*, pl. 3, fig. 36, 1874.

EXAMINATIONS: None.

TYPE LOCALITY: Road between Cadnam and Poultons, in the New Forest, Hampshire, England (C. Lyell) December, 1912.

RANGE: N. H. (185); Eur. (409).

#### PTILIDIOIDEAE<sup>s</sup>

Branches from the ventral half of the leaf axil, the subtending leaf often with one of its lobes wanting. Leaves alternate, transversely inserted to somewhat succubous, not or but slightly decurrent, with 2 to about 5 lobes; lobes from wide to a single row of cells, often ciliate; sinus deep, in ours descending  $\frac{1}{4}$  to almost the whole leaf length. Underleaves present throughout, in most genera (all of ours) similar to the leaves in form and approaching them in size. Plants unisexual or usually bisexual. Female inflorescence terminal on a main stem or normal large branch but never on a ventral branch; female bracts<sup>9</sup> and bracteoles free from each other, or in some genera variously united with each other or with the perianth. Perianth usually present, or wanting (in *Tricholea* among ours). Sporangia immersed to excurrent, ovate and with straight valves, or cylindric and with spiral valves; the walls 2-8 cells thick; the innermost layer of wall cells with semiannular thickenings.

The chief character uniting the group is the presence, except in *Gyrothyra*, of very large underleaves, so large that in some genera one can hardly distinguish them from the leaves. *Herberta* is considered low on account of the presence of antheridia in the axils of bracteoles as well

<sup>s</sup> ti li' dī ōi' dē ē.

<sup>9</sup> By female bracts we mean only the inner pair of bracts, nearest to the perianth when that is present, unless archegonia actually occur in the axils of others. By female bracteoles we mean only the bracteoles associated with the bracts as defined above. The terms are too vague when applied to all the usually larger leaves and underleaves near the perianth which gradually grade into those below.



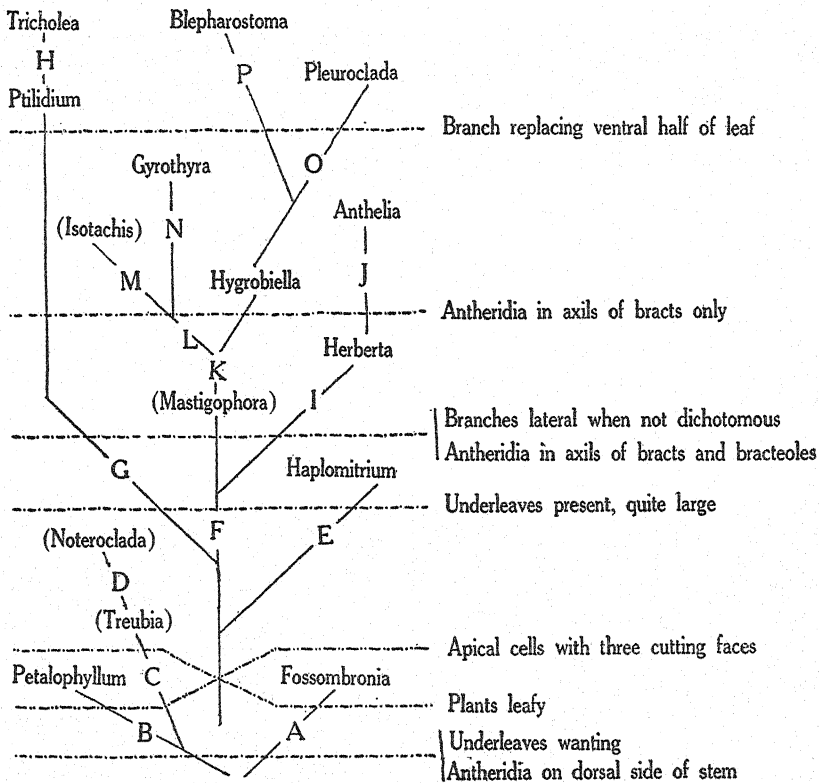
as of the bracts, and it carries the group with it. But whether all the genera usually put here belong here, and whether no others belong here, is not clear with the present knowledge of their morphology. We put *Gyrothya* here, close to the tropical genus *Isotachis*, because the two agree in having cylindric sporangia with spiral valves. These are reproductive characters, while leaf-notching and size of underleaves are purely vegetative.

- A. Leaf sinuses  $\frac{1}{4}$  or more of the leaf length.
- B. Leaves with a sharply defined vein-like region of longer cells, one fork of which enters each of the 2 lobes; flagelliform branches not uncommon; trigones bulging into the cells. . . . . *Herberta*, p. 176.
- BB. Leaves without a sharply defined vein-like region, lobes 2 or more; flagelliform branches wanting.
- C. Leaves with 2 wide lobes, entire to denticulate, their tips without hair points.
- D. Leaves longer than wide, their lobes mostly acute; underleaves 2-lobed or with occasional ones not lobed, without a basal tooth.
- E. Leaves bilobed for  $\frac{1}{2}$ – $\frac{2}{3}$  their length; rhizoids numerous toward base; female bracts united with the base of the perianth. . . . . *Anthelia*, p. 180.
- EE. Leaves bilobed for  $\frac{1}{4}$ – $\frac{1}{2}$  their length; rhizoids scarce; female bracts not united with the perianth. . . . . *Hygrobella*, p. 185.
- DD. Leaves wider than long, their lobes obtuse; underleaves not lobed, sometimes with a tooth at one side near base. . . . . *Pleuroclada*, p. 187.
- CC. Leaves with 4 to many lobes or with only 2 terete lobes, margins ciliate or the lobes ending in hair points.
- F. Leaf cells with large or bulging trigones; female inflorescence on a short lateral branch; perianth present. . . . . *Ptilidium*, p. 195.
- FF. Leaf cells without trigones; female inflorescence on a normal lateral branch or on a main stem.
- G. Each of the 2-5 leaf lobes a cilium, thus all of the cilia originating near the base of the leaf; perianth present. . . . . *Blepharostoma*, p. 190.
- GG. Each of the several lobes with numerous marginal cilia, thus most of the cilia originating not near the leaf base; perianth wanting. . . . . *Tricholea*, p. 201.  
*Gyrothya*, p. 203.
- AA. Leaf sinus wanting, leaves rounded at apex. . . . .

#### RELATIONSHIPS AMONG NORTH AMERICAN PTILIDIOIDEAE AND HAPLOMITRIOIDEAE

The remarks below are pertinent at the corresponding letters on the diagram on the opposite page:

- (A) Leaves succubous. Wall of sporangium 2 cells thick.
- (B) Thalloid; dorsal lamellae on thallus at right angles to axis. Wall of sporangium 3-4 cells thick.
- (C) "Leaves" almost parallel with the stem but overlapping succubously; dorsal scales on stem and base of leaf at right angles to axis.



Phylogenetic diagram of North American Haplomitrioideae and Ptilidioideae.

(D) Leaves very succubously inserted, more than 50 degrees from transverse.

(E) Wall of sporangium 1 cell thick.

(F) Leaves 2-lobed, shallowly or not at all so in G, the lobes not ciliate except in P.

(G) Leaves ciliate. Wall of sporangium 2-4 cells thick; in cross section of seta the epidermal cells larger than the interior ones.

(H) Wall of sporangium 6-8 cells thick.

(I) Vitta present. Wall of sporangium several cells thick; in cross section of seta the epidermal cells larger than the interior ones.

(J) Perianth and bracts somewhat united at base. In cross section of seta the epidermal cells very similar to the interior ones.

(K) Cross section of seta consisting of 8 epidermal cells and 4 smaller interior ones.

(L) Some or all of the branches ventral. Sporangium cylindric, with spiral valves.

(M) Rhizoids wanting; leaves transversely inserted, primarily 2-lobed; underleaves similar to the leaves and only slightly smaller; perigynium rather questionable. Structure of seta unknown.

(N) Rhizoids numerous, in tufts; leaves transversely inserted; not lobed or very shallowly 2-lobed; underleaves 2-lobed, much smaller than the leaves; perigynium well developed. Seta in cross section of 16 epidermal cells and about 31 smaller interior ones, 6-8 cells thick.

(O) In cross section of seta the epidermal cells larger than the interior ones.

(P) Lobes of leaves mere cilia. In cross section of seta the epidermal cells slightly larger than the interior ones.

HERBERTA<sup>10</sup> S. F. Gray Nat. Arr. Brit. Pl. 1:705, 1821.

*Schisma* Dum. Comm. Bot. 114, 1822.

*Sendtnera* Endl. Gen. Pl. 1342, 1840.

Plants rather to quite large, rigid, yellowish green to reddish brown or purplish. Stems from a slender rhizome, procumbent to erect, innovating from beneath the female inflorescence; branches none or few, from the axils of the lateral leaves. Rhizoids few, scattered, near base, sometimes also on rhizome. Leaves alternate, incubous but almost transversely inserted, not decurrent, secund, simply 2-lobed, widest below the middle, with a vein-like band of cells in the middle; band rather wide, 1 cell thick, forking, one branch entering each of the two lobes of the leaves; lobes long, narrow, acuminate; sinus descending  $\frac{1}{2}$ - $\frac{4}{5}$  the leaf length. Cells of the median leaf band elongate, thick walled with a thin spot between contiguous cells; cells between band and margin with large bulging trigones. Underleaves present throughout, very similar to the leaves in size and form, transversely inserted. Plants unisexual. Male inflorescence near the end of the stems or branches; male bracts relatively few, resembling the leaves, less deeply lobed, ventricose at base; the margins with papilliform teeth at base, strongly recurved; antheridia 2-5, in the axils of both male bracts and bracteoles. Female inflorescence terminal; female bracts several, closely imbricate, very similar to the leaves in form; bracteoles similar to the bracts. Perianth narrow, ovate-subulate, but little emergent, 3-keeled, not greatly contracted to mouth; mouth rather wide for the perianth, deeply lobed or lacinate, plicate. Seta very short. Sporangium globose to ovoid, large, 4-valved but often up to 8-valved

<sup>10</sup>hēr' bēr tī. Gray spelled it Herbertus; Carrington (Trans. Bot. Soc. Edinburgh 10:309, 1870) changed the gender. As to accent, we retain the natural pronunciation of the man's name in so far as good sense permits.

through splitting, with wall several cells thick; innermost wall with semi-annular thickenings. Named in honor of George Herbert, a patron of Micheli.

- Leaves mostly 1.2-1.5 mm long and 450-500  $\mu$  wide, their lobes strongly curved, basal margins entire or nearly so..... 1. *H. hutchinsiae*.  
 Leaves mostly 0.9-1 mm long and 300-350  $\mu$  wide, their lobes not or little curved, basal margins entire or sparingly lobed to coarsely toothed..... 2. *H. tenuis*.

1. *Herberta hutchinsiae*<sup>11</sup> (Gottsche & Rabenh.) Evans, Bull. Torr. Bot. Club 44:214, 1917.

*Jungermannia juniperina* var.  $\beta$  Hook. Brit. Jung., pl. 4, 1816, in part.

*Sendtnera adunca* var. *hutchinsiae* Gottsche & Rabenh. Hep. Eur. 210, 1862.

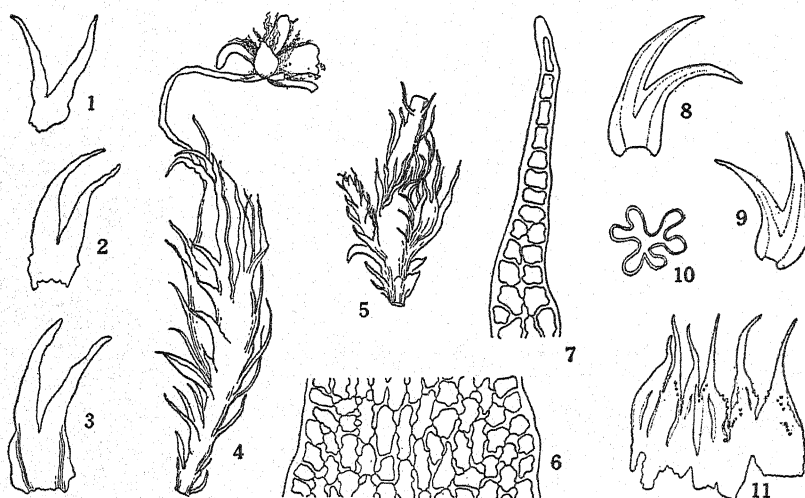
*H. adunca* var. *hutchinsiae* Schiffn., Lotos 60:54, 1912.

Plants scattered among mosses or in tufts or mats, yellowish green to brownish green or reddish to purplish. Stems 3-12 cm long, erect to ascending or pendulous, from a prostrate rhizome, with few or no branches, rigid, about 250  $\mu$  wide and 200  $\mu$  thick, with flagella bearing small leaves; in cross section about 14 cells thick, the cell walls everywhere thick but more so in the cortical region than in the interior. Rhizoids few, almost entirely near the base. Leaves alternate, incubous but almost transversely inserted, unsymmetric, not decurrent, rather loosely imbricate, squarrose when damp, falcato-secund when dry, simply but deeply 2-lobed, ovate-lanceolate to ovate, mostly 1.2-1.5 mm long and 450-500  $\mu$  wide, rigid; vein-like band distinct, 1 cell thick, forked, one fork passing into each lobe and extending  $\frac{1}{2}$ - $\frac{3}{4}$  its length, below its fork the band mostly 150-180  $\mu$  long and 250-300  $\mu$  wide; margin entire or slightly sinuous, sometimes with a few marginal papillae near base, entire along the lobes; lobes linear-lanceolate, strongly curved, somewhat divergent, longly acuminate; sinus descending  $\frac{2}{3}$ - $\frac{4}{5}$  the leaf length, acute to obtuse. Cells of the vein-like band mostly 30-75  $\mu$  long and 14-18  $\mu$  wide in the basal portion, in its divisions mostly 25-50  $\mu$  long and 18-20  $\mu$  wide, the wall thick except for one thin spot between each cell and every one contiguous with it; cells between margin and vein-like band 15-24  $\mu$ , with bulging trigones and one thin spot between almost every two contiguous cells; cells of the marginal row 15-18  $\mu$ , their marginal walls uniformly thick and  $\frac{1}{2}$ - $\frac{3}{4}$  as thick as the width of the cell hollow; cuticle faintly but distinctly striate-verruculose. Underleaves present throughout, similar to the leaves but symmetric, with straight lobes. Plants unisexual. Male inflorescence below the tip of the stem or rarely on a lateral or ventral branch; male bracts usually 8-12, larger than the leaves, less deeply lobed, closely imbricate, slightly ventricose at base; the mar-

<sup>11</sup> hüt chün' sí ē.



gins subentire to sparingly and irregularly dentate; the lobes slightly unequal, straight, acute; male bracteoles like the bracts; antheridia 2-3, in the axils of both male bracts and bracteoles. Female inflorescence terminal; female bracts larger than the leaves; the innermost leaves mostly 2.5-3.5 mm long and 700-900  $\mu$  wide, slightly ventricose at base, chan-



*Herberta hutchinsiae*. 1-2, Underleaves, x12.6. 3, Leaves, x15. 4, Sporophyte on tip of plant, x5.3. 5, Branch and rejuvenation, x5.3. 6, Leaf cells, the vaguely vein-like region as longer cells in the middle, x104. 7, Cells of leaf tip, x110. 8-9, Leaves, the dotted lines outlining the vein-like region, x17. 10, Transverse section of perianth, x17. 11, Perianth, spread out flat, x11.6. (8-11, after Evans; 1-7, original, by Elizabeth Curtis.)

nelled, bilobed for about  $\frac{1}{2}$  their length; their lobes acuminate, broadly hyaline, denticulate at margin; the sinus acute, closed; bracteole bilobed for about  $\frac{1}{3}$  its length, erose-denticulate, the tips of the lobes acute to truncate. Perianth  $\frac{1}{8}$ - $\frac{1}{4}$ -emergent, ovoid, about 3.5 mm long and 800  $\mu$  wide, cleft to about the middle into 6 lobes; the lobes lanceolate, longly acuminate, with numerous papillae on basal margin and on inner surface; mouth wide; paraphyllia occasionally present, small, irregular. Seta very short or hardly present. Sporangium immersed, ovoid, about 1 mm long, 6-8-valved to base, brown; wall 2 cells thick, the innermost layer with semiannular thickenings. Elaters about 10  $\mu$  thick; spirals usually 2, rarely 3, brown. Spores about 25  $\mu$ , minutely echinulate, brown. Named in honor of Miss Hutchins, who collected extensively in Ireland, and who gathered the type material.—On moist or wet substratum of peaty soil, or rocks; alpine but descending to within a few hundred feet of sea level.

ILLUSTRATIONS: Evans, Bull. Torr. Bot. Club 44: pl. 8, 1917; Macvicar (374) 346, figs. 1-5.

EXAMINATIONS: *Alaska*. Aats Bay (Frye) 1913; Augustine Bay (Frye) 1913; Dall Island (Frye) 1913; Metlakatla (Frye) 1913.—*B.C.* Hope (Frye) 1928; Swanson Bay (Frye) 1913.—*Wash.* North Bend (Frye) 1926.

TYPE LOCALITY: Bantry, Ireland (Miss Hutchins).

RANGE: *Alaska* (183), *B. C.* (183), *Wash.* (84); *Eur.* (183).

All reports of *Herberta adunca* S. F. Gray from western North America are probably *H. hutchinsiae* (183).

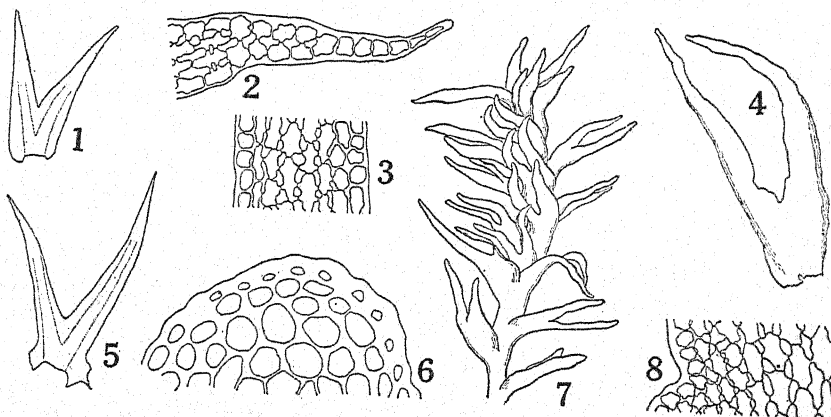
2. *Herberta tenuis*<sup>12</sup> Evans, Bull. Torr. Bot. Club 44:219, 1917.

*Schisma juniperinum* Sull. Musc. Alleghenienses Exsic. No. 258, 1846. Not of Dum. Comm. Bot. 114, 1822.

*Sendtnera juniperina* Sull., in A. Gray Manual 689, 1848. Not of G. L. & N. Syn. Hep. 239, 1845.

*H. adunca* Underw., Bot. Gaz. 14:195, 1889. Not *Herbertus aduncus* of S. F. Gray Nat. Arr. Brit. Pl. 1:705, 1821.

Plants in patches or mats, yellowish green to brownish green or reddish. Stems mostly 2-4 cm long, erect or ascending, from a prostrate rhizome, sparingly and irregularly branched, rigid, about 150  $\mu$  wide and 130  $\mu$  thick; in cross section about 10 cells wide and 9 cells thick, the outer cells with strongly thickened walls, the interior ones with slightly thickened ones. Rhizoids none, or a few at base. Leaves alternate, incubous but almost transversely inserted, slightly unsymmetrical, not decurrent, distant to loosely imbricate, erect-spreading to subsquarrose or slightly secund, simply 2-lobed, somewhat ovate, mostly 0.9-1 mm long and 300-



*Herberta tenuis*. 1, Leaf, x28. 2, Cells of the leaf tip, x97. 3, Cells from about the middle of a leaf lobe, x97. 4, Leaf, x51. 5, Leaf, x28. 6, Cross section of mature stem, in part, x356. 7, Tip of plant, x34. 8, Cells from basal region of leaf, x97. (1, 5, 6, after Evans; 2-4, 7-8, original, by Elizabeth Curtis.)

<sup>12</sup> tēn' ū is.

350  $\mu$  wide, rigid; vein-like band distinct, 1 cell thick, forked, one fork passing into each lobe and extending  $\frac{1}{3}$ – $\frac{2}{3}$  its length, below its fork the band mostly 100  $\mu$  long and 150  $\mu$  wide; margin entire or sinuate to usually irregularly toothed near base; lobes linear-lanceolate, straight to slightly curved, somewhat divergent, acuminate, their margins entire or occasionally with a basal tooth; sinus descending  $\frac{2}{3}$ – $\frac{3}{4}$  the leaf length, acute to obtuse. Cells in the basal region of the vein-like band mostly 20–55  $\mu$  long and 14  $\mu$  wide, in its divisions mostly 20–35  $\mu$  long and 14  $\mu$  wide, the wall thick except for one thin spot between each cell and every one contiguous with it; cells between the margin and vein-like band gradually shorter to the isodiametric ones near margin, about 20  $\mu$ , with bulging trigones and one thin spot between most of the contiguous cells; cells of the marginal row in the basal portion about 14  $\mu$ , in the lobes about 17  $\mu$ , their marginal walls uniformly thick and about  $\frac{1}{3}$ – $\frac{1}{2}$  as thick as the width of the cell hollows; cuticle minutely striate-verruculose. Underleaves present throughout, like the leaves in form and size but symmetric. Inflorescences and sporophyte unknown. Name the *L. tenuis*, thin; in reference to the usually narrower leafy branches in comparison with other species.—On moist or peaty soil or on rocks; on mountains.

ILLUSTRATIONS: Evans, Bull. Torr. Bot. Club 44:220, figs. 21–29, 1917; Haynes, Bryologist 30: pl. 3, fig. 3, 1927; Ammons (3.1) 133, fig. B.

EXAMINATIONS: N. C. Chestnut Bald Mts. (Grout 588) 1907; Grandfather Mt. (Sharp 36150) 1936; Great Smokey Mts. (Taylor 2810) 1934; Jones Knob near Balsam (Blomquist 6358) 1928; Winston-Salem (Schallert 7555) 1923.

TYPE LOCALITY: Grandfather Mountain, North Carolina (J. K. Small 32) August, 1891.

RANGE: N. Y. (183), Pa. (183), N. J. (183), Va. (271), W. Va. (3.1), Ky. (2.1), Tenn. (464), N. C. (43).

*H. tenuis* has not been found reproducing. The smallest leaves of *H. hutchinsiae* and the largest of *H. tenuis* intergrade and thus the two species are not well separated. Unless the reproductive structures of *H. tenuis* prove to be different from those of *H. hutchinsiae* we would consider the former a variety of the latter. All reports of *H. adunca* S. F. Gray from eastern North America may be considered *H. tenuis* (183).

ANTHELLIA<sup>18</sup> Dum. Rec. d'Obs. 18, 1835.

*Chandonanthus* Mitt., Hooker Handb. New Zealand Fl. 2:750, 1867.

Plants gregarious or in patches or mats, small. Stems rather stiff; branches unequally pinnate or somewhat fasciculate, from the axils of the lateral leaves; flagella wanting. Leaves almost transversely inserted but inclined to be incubous, not decurrent, simply 2-lobed, rather small, dorsally convex, channeled, margin entire to denticulate; sinus descending  $\frac{1}{2}$  or more of the leaf length. Underleaves much like the leaves in size and form, present throughout. Plants unisexual or bisexual. Antheridia

<sup>18</sup> ăn thể II ã.

1 in each axil, large; paraphyses wanting or nearly so. Female inflorescence terminal on stem or well developed branch; female bracts larger than the leaves. Perianth united with the base of bracts, with a deep dorsal groove, with 2-3 keels ventrally, 8-10-plicate, thin, slightly contracted toward mouth; mouth wide, denticulate. Calyptra with sterile archegonia on its surface. Seta short, in cross section the outer cells hardly larger than the inner. Sporangium with 2 layers of wall cells, the inner layer with semiannular thickenings. Name from Gk. *anthelion*, a floret; in reference to the flower-like manner in which the perianth is cleft.

Our two species are too much alike to be separated with certainty by vegetative characters. The distribution of the two leads one to suspect that they may prove to be variations of a single species.

Plants unisexual; perianth about twice as long as wide; in cross section of seta the epidermal cells larger than the interior ones.

1. *A. julacea*.<sup>14</sup>

Plants bisexual; perianth 1-1¼ times as long as wide; in cross section of seta the epidermal cells about the same size as the interior ones.

2. *A. juratzkana*.

1. *Anthelia julacea*<sup>15</sup> (L.) Dum. Rec. d'Obs. 18, 1835.

*Jungermannia julacea* L. Sp. Pl. 1135, 1753.

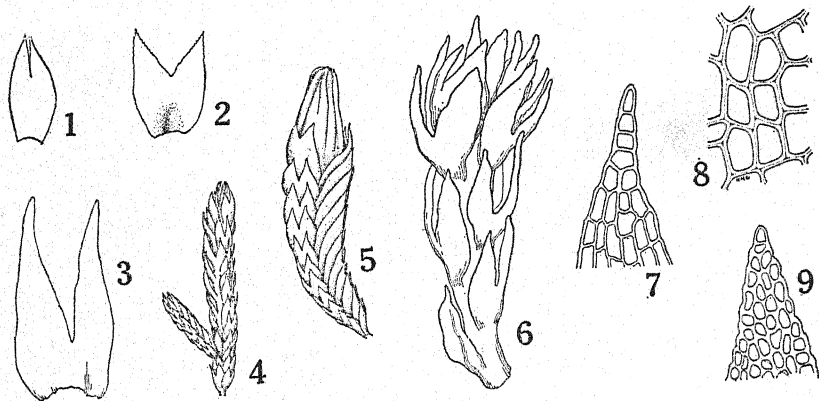
Plants in compact patches or mats, dark green to dark yellowish green or brownish, often glaucescent when dry. Stems 0.5-4 cm long, procumbent to erect, filiform, brown, irregularly pinnately branched; branches rather numerous especially from beneath the perianth, from the axils of the lateral leaves. Rhizoids numerous near base of stem, scarce toward apex, colorless. Leaves alternate, nearly transverse, with a slight tendency toward incubous, not decurrent, loosely to densely imbricate, suberect to erect, appressed or the tips incurved, 650-700  $\mu$  long, simply 2-lobed, ovate, somewhat convex dorsally, somewhat channelled, 2-3 cells thick below the sinus; margin sinuate to subdenticulate especially toward tips of lobes, sinuate or entire nearer base, more or less widely recurved, inclined to be somewhat translucent; lobes equal, lanceolate to somewhat ovate-lanceolate, acute to acuminate, the apical cell often hyaline; sinus descending to  $\frac{2}{3}$  the leaf length or less, narrow, acute. Cells of the leaf middle 18-28  $\mu$ , of the margin and tips 12-18  $\mu$ , quadrate to hexagonal; walls strongly and equally thickened throughout the leaf; trigones wanting; cuticle minutely punctate or smooth. Underleaves the same in form as the leaves, equalling them in size or slightly smaller. Plants unisexual; both inflorescences on main stems or on normal lateral shoots. Male inflorescence terminal or farther down; male bracts several

<sup>14</sup> Our Greek and Latin departments are unanimous in the opinion that these should be *julaceum* and *juratzkanum* to agree with *Anthelia*. The feminine ending, however, is in universal use.

<sup>15</sup> jū lā' sē ä.



pairs, closely imbricate, convex dorsally at base, larger than the leaves, 2-lobed for  $\frac{1}{2}$ – $\frac{3}{4}$  the length; the lobes ovate, acute, entire, somewhat unequal; antheridium 1; paraphyses wanting. Female inflorescence terminal, often with an innovation; female bracts much larger than the leaves, deeply channelled, 2-lobed; the lobes acute, erose-dentate at margin and broadly hyaline; the sinus  $\frac{1}{3}$ – $\frac{1}{2}$  the bract length, acute, closed; bracteole long-oval, about  $\frac{1}{2}$ -bifid by narrow sinus. Perianth about  $\frac{1}{2}$ -emergent, oblong to longly ovoid, 1-1.5 mm long, 600-750  $\mu$  thick, often deeply 4-plicate above the middle, rather slightly contracted at tip; mouth wide, hyaline, with many unequal teeth or lobes. Seta about 4 mm long, in cross section of 16 large epidermal cells with smaller ones in the interior. Sporangium ovoid-globose, 490-700  $\mu$  thick, dark brown, the wall of 2 lay-



*Anthelia julacea*. 1, Underleaf,  $\times 30$ . 2, Leaf; the shaded portion 2-3 cells thick,  $\times 30$ . 3, Leaf,  $\times 34$ . 4, Part of sterile plant,  $\times 8.8$ . 5, Part of plant with perianth,  $\times 10.6$ . 6, Tip of plant,  $\times 34$ . 7, Leaf tip,  $\times 151$ . 8, Cells of leaf middle outside the vein-like region,  $\times 356$ . 9, Cells of leaf tip,  $\times 162$ . (1-2, 4-5, 9, after K. Mueller. The others original; 8, by Helen Gilkey; 3, 6-7, by Elizabeth Young.)

ers of cells; inner layer of wall cells with numerous semiannular thickenings. Elaters 120-175  $\mu$  long, 8-14  $\mu$  thick, short; spirals 2, wide, reddish brown. Spores 12-24  $\mu$ , minutely verruculose, reddish brown. Name from Gk. *ioulos*, a bundle, in botany an ament, and *-acea*, similar to; in reference to the ament-like tips of the branches with their closely imbricate leaves.—In wet places; on soil, peat or rock; subalpine to alpine.

ILLUSTRATIONS: Hooker (285) pl. 2; Pearson (433) 2: pl. 35; K. Mueller (409) 2: fig. 94; Meylan (386) fig. 172; Macvicar (374) 345, figs. 1-6; Gil (76) fig. 309; Ekart (124) pl. 8, fig. 61; Jensen (323.5) 169, 4 figs.

EXAMINATIONS: *Alaska*. Port Malmsbury (Frye) 1913; St. Paul Island (Kincaid) 1897.—*Cal.* Garnet Lake in Madera County (Howell 584) 1941.—*Wash.* Glacier Basin in Cascade Mts. (Bailey) 1929.

TYPE LOCALITY: European.

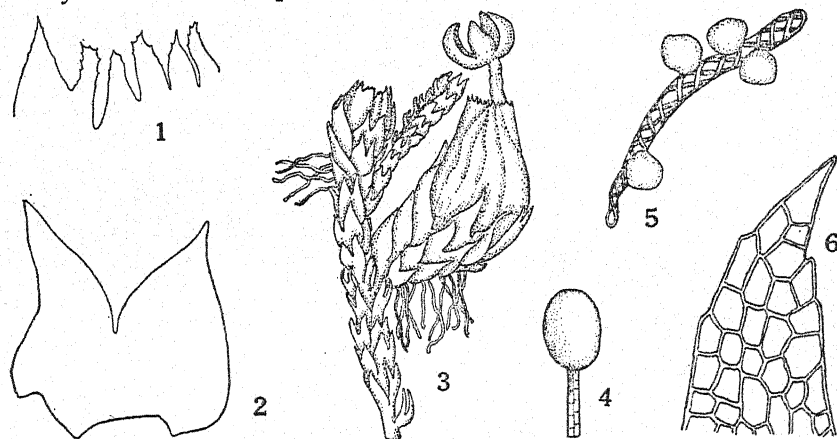
RANGE: Greenland (431), Ellesmere Isl. (409), Baffin Isl. (485.6), Que. (485.6), Mont. (328), Alaska (239.1), B. C. (508), Wash. (81), Ore. (457), Cal.; Asia (308.1); Eur. (444.02); Spitzbergen (476); Iceland (476); Jan Mayen Isl. (248.1).

This has been reported from California (504). Howe (296) found one specimen collected by Bolander labeled *A. julacea*, but it proved to be *A. juratzkana*. The report of it from California was very likely based upon this material. *A. julacea* var. *sphagnicola* C. Jens. (Medd. om Groenland 15:375, 1897), with dark stem and distant leaves, does not seem to us to merit a new variety. Its growth among *Sphagnum* would indicate conditions of moisture and perhaps of shade which would cause the stem to elongate and thus to separate the leaves more than usual.

2. *Anthelia juratzkana*<sup>16</sup> (Limpr.) Trev., Mem. Istit. Lomb., Ser. 3, 4:416, 1877.

*Jungermannia juratzkana* Limpr., Cohn Krypt.-Fl. Schlesien 1:289, 1876.

Plants gregarious or usually in small patches, forming an almost crustlike layer, dark green or dark yellowish green, sometimes grayish with fungi; shoots densely leafy, clavate. Stems 2-5 mm long, the decumbent bases thickly matted together, with several branches; branches somewhat fasciculate, ascending, originating in the lateral leaf axils, short, usually clavate toward tip. Rhizoids numerous toward base of stem, com-



*Anthelia juratzkana*. 1, Part of mouth of perianth,  $\times 44.5$ . 2, Male bract,  $\times 39$ . 3, Part of plant with two perianths and male branch beneath the upper one,  $\times 16$ . 4, Antheridium,  $\times 90$ . 5, Trispiral elater and spores,  $\times 381$ . 6, Tip of a leaf,  $\times 233$ . (1, 4, after Pearson; the others after K. Mueller.)

mon on the branches, short. Leaves alternate, transversely inserted or with a slight tendency toward incubous, not decurrent, sometimes approximately imbricate on lower part of stems to densely imbricate near tips, erect-spreading and incurved to erect-appressed, simply 2-lobed, ovate, somewhat convex dorsally, somewhat channelled; margin slightly

<sup>16</sup> yū rätz kā' nā; retaining the soft "j" sound of Juratzka's name.

dentate to entire above, entire toward base of leaf; lobes lanceolate or ovate-lanceolate, acute or acuminate; sinus descending about  $\frac{2}{3}$  the leaf length, acute, narrow. Cells of the leaf middle 20-30  $\mu$ , of the margin and lobes 15-20  $\mu$ , mostly rectangular, more pellucid than in *A. julacea*; walls somewhat thick, but less so than in *A. julacea*; cuticle minutely punctate. Underleaves like the leaves, slightly or hardly smaller. Plants bisexual. Male inflorescence just below the female or farther down; male bracts larger than the leaves, deeply bilobed but less deeply so than the leaves, several pairs, closely imbricate, slightly ventricose at base, the dorsal margin often with a rounded lobe near base; the two terminal lobes somewhat unequal, ovate, acute; antheridium 1; paraphyses wanting. Female inflorescence terminal; female bracts larger than the leaves, at base slightly ventricose and wider than the leaves, deeply channelled, 2-lobed to  $\frac{1}{3}$ - $\frac{1}{2}$  the length; the lobes acute, denticulate, broadly hyaline; the sinus acute, closed; bracteole 2-lobed for about  $\frac{1}{3}$  its length, acute to truncate, denticulate. Perianth  $\frac{1}{6}$ - $\frac{1}{2}$ -emergent, ovoid, deeply plicate above the middle, cleft about  $\frac{3}{4}$  its length, not greatly contracted at mouth; mouth wide, hyaline, denticulate with numerous unequal teeth. Seta about 3 times as long as the sporangium, in cross section composed of cells all about the same in size. Sporangium ovoid-globose; valves 4, ovate, extending to base; wall of 2 layers of cells; inner wall layer with fewer semiannular thickenings in the wall than in *A. julacea*. Elaters 6-8  $\mu$  thick; spirals usually 3, sometimes 2, light brown. Spores 16-20  $\mu$ , minutely verruculose, light brown. Named in honor of J. Juratzka, who was the first or one of the first to find it.—In moist places; on rocks or peaty soil; alpine.

ILLUSTRATIONS: Pearson (433) 2: pl. 35; K. Mueller (409) 2: fig. 95; Macvicar (374) 346, figs. 1-5; Gil (76) fig. 308.

EXAMINATIONS: *Alta.* Healy Creek (Brinkman 927) 1913; Jasper Park (MacFadden 310) 1926; Simpson Pass (Brinkman 977) 1913.—*B. C.* Golden (W. R. Taylor 29) 1923; Lake of Hanging Glaciers (MacFadden 1008) 1928; Revelstoke (W. R. Taylor 102, 37) 1921.—*Mich.* Pictured Rocks in Alger County (Steere 728) 1934.—*N. H.* Mt. Monroe (Lorenz) 1916.—*Wash.* Mt. Rainier (Foster 1014) 1909.

TYPE LOCALITY: On the south side of the "Brunnengebirges" in the "Riesengebirge," probably in the Czechoslovakian area which became a part of Germany in 1938 (Limpricht) 1871, at 1300 meters.

RANGE: Greenland (248), Pim Isl. (56.01), Ellesmere Isl. (56.01), Devon Isl. (485.6), Baffin Isl. (485.6), N. H. (203), Mich. (484), Alta. (46.2), Alaska (373), B. C. (97.2), Wash. (81), Cal. (296); Eur. (476); Spitzbergen (524.3).

*A. nivalis* Sw. in Web. & Mohr Ind. Musc. 5, 1803, would supersede *A. juratzkana* as the name if it were certain that Swartz had this plant. *A. juratzkana* cannot be distinguished with certainty from *A. julacea* when sterile. Limpricht in 1877 was the first to point out the difference in reproductive structures. *A. nivalis* Sw., and of Wahl. Fl. Suecica, may therefore have been either *A. julacea* or *A. juratzkana*. Reports before 1877 of the occurrence of these two species often have a large element of uncertainty. *Jungermannia julacea* var. *clavigera* Nees Naturg. Eur.

Leberm. 2:307, 1836, and *J. julacea* var. *glaucescens* G. L. & N. Syn. Hep. 147, 1844, are uncertain for the same reason. It is probable that C. Jensen (320 and 322) is using the name *Anihelia nivalis* as a synonym of *A. juratzkana* although Howe (296) in 1899, eight years before Jensen's (322) report of *A. nivalis* in Greenland, makes it clear that *A. nivalis* may be either *A. juratzkana* or *A. julacea*.

**HYGROBIELLA**<sup>17</sup> Spruce, On Cephalozia 73, 1882.

Plants olive green to blackish brown. Stems .5-2 cm long, fleshy; normal branches lateral, from the ventral half of the leaf axil, not replacing the ventral half of the leaf. Rhizoids scarce, short, violet-red. Leaves alternate, almost transversely inserted, rarely somewhat succubous, not decurrent, 2-lobed; lobes acute to obtuse; sinus descending  $\frac{1}{4}$ - $\frac{1}{2}$  the leaf length. Leaf cells large, thin walled. Gemmae unknown. Underleaves very large, the upper of female branches as large as the leaves. Plants unisexual. Male inflorescence terminal or intercalary; male bracts 8-14, broadly ovate, 2-lobed for  $\frac{1}{4}$ - $\frac{1}{3}$  their length; the lobes unequal, obtuse; male bracteole lanceolate, not lobed; antheridia 1 per bract. Female bracts as large as the upper leaves, broadly lanceolate, spreading; bracteole similar to the bracts. Perianth oblong-fusiform to clavate or cylindric, bluntly 3-angled above, emergent for about  $\frac{7}{8}$  its length; mouth decolorate, 3-lobed and denticulate by projecting finger-like hyaline cells. Sporangium oblong-ovoid; its wall of 2 layers of cells. Name from Gk. *hygros*, dampness, and *bios*, life; in reference to wet habitat.

1. *Hygrobrella laxifolia*<sup>18</sup> (Hook.) Spruce, On Cephalozia 74, 1882.

*Jungermannia laxifolia* Hook. Brit. Jung., pl. 59, 1816.

*Gymnocolea laxifolia* Dum. Rec. d'Obs. 17, 1835.

*Jungermannia huebeneriana* Nees Naturg. Eur. Leberm. 2: 316, 1836.

*Gymnocolea huebeneriana* Dum. Hep. Eur. 64, 1874.

*Cephalozia laxifolia* Lindb. Musci Scand. 3, 1879.

*Cephalozia notarisiana* Massal., Accad. Sci. Med. et Nat. Ferrara 201, 1903.

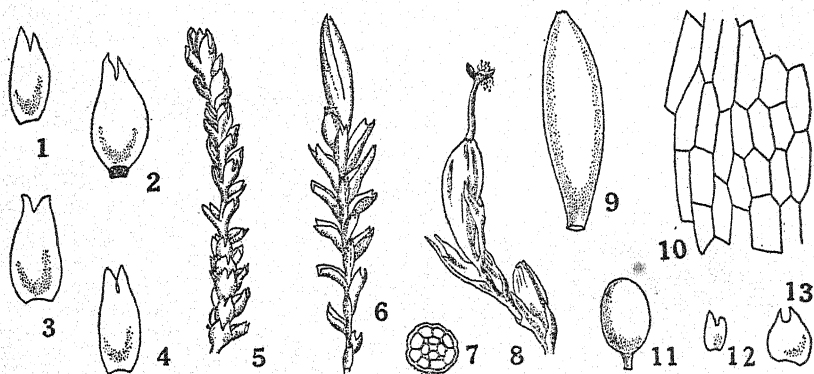
Plants in patches, olive green to olive brown or reddish brown to blackish. Stems 5-20 mm long, suberect, filiform; normal branches lateral, ascending; flagella from near base, with small or no leaves; cortical cells larger than the interior ones, transparent, interior cells brownish. Rhizoids scarce, short, on the base of the stem and on the flagella. Leaves alternate, transversely inserted, not decurrent, distant except imbricate near tip of fertile stem, erect-spreading to spreading, simply 2-lobed, lanceolate to elliptic, up to 1 mm long and 550  $\mu$  wide, larger toward tip of stem, minute toward base, roundedly concave adaxially, flaccid; lobes usually unequal, the ventral the larger, narrow, acute to obtuse; sinus descending  $\frac{1}{4}$ - $\frac{1}{2}$  the leaf length, narrow, acute. Cells of the middle of the larger leaves 40-70  $\mu$  long and about 20  $\mu$  wide, varying with the size

<sup>17</sup> hŷ" grō bī ēl' lā.

<sup>18</sup> lāx ī fō' ī ā.



of the leaf, mostly about twice as long as wide, rectangular, pellucid; walls slightly and equally thickened, brownish; trigones wanting; cuticle smooth. Underleaves quite common, large, resembling the leaves but rather smaller and more irregular in form, up to 1 mm long and  $500\ \mu$  wide, sometimes a few not lobed. Plants unisexual. Male inflorescence terminal or near the middle of the shoot, or terminal on short branches which are leafless at base; male bracts 8-14, loosely imbricate, larger than the leaves, ventricose, occasionally with a tooth on the dorsal margin;



*Hygrobiella laxifolia*. 1, Leaf,  $\times 12.7$ . 2, Female bracteole,  $\times 12.7$ . 3, Female bract,  $\times 12.7$ . 4, Underleaf,  $\times 12.7$ . 5, Male shoot,  $\times 10.6$ . 6, Female shoot,  $\times 8.5$ . 7, Cross section of seta,  $\times 59$ . 8, Female shoot,  $\times 11.6$ . 9, Perianth,  $\times 12.7$ . 10, Cells of leaf,  $\times 200$ . 11, Antheridium,  $\times 44$ . 12, Male bracteole,  $\times 12.7$ . 13, Male bract,  $\times 12.7$ . (5, after K. Mueller; 7, after Douin; 8, after Hooker; the others after Pearson.)

antheridium 1, large, with a very short stalk. Female inflorescence terminal on the stem or on normal branches, often with innovations below it; female bracts much like the leaves, longer,  $\frac{1}{5}$ – $\frac{1}{4}$ -bilobed; bracteole much like the bracts but sometimes entire. Perianth oblong-fusiform, large, about 2 mm long and  $500\ \mu$  wide, emergent for about  $\frac{7}{8}$  its length, obtusely 3-angled, of 2 layers of cells from near base to above the middle, often decolorate near mouth, obtusely to roundedly contracted to the mouth; mouth almost closed, not tubular, somewhat denticulate with long hyaline cells. Seta 4-5 mm long. Sporangium narrowly oblong-ovoid, reddish brown, the wall of 2 layers of cells. Elaters about 1 mm long and  $12$ – $13\ \mu$  thick; spirals 2, reddish brown. Spores about  $20\ \mu$ , smooth, reddish brown. Name from *L. laxus*, loose, not close together, and *folium*, leaf; in reference to the distant leaves other than near the tip of the stem.—On wet rocks; subalpine and alpine.

ILLUSTRATIONS: K. Mueller (409) 2: fig. 28; Hooker (285) pl. 59; Pearson (433) 2: pl. 77; Macvicar (374) 302, figs. 1-4; Ekart (124) pl. 1, fig. 8; Meylan (386) fig. 140; Jensen (323.5) 215, 3 figs.; Gil (76) fig. 283; Douin, Bull. Soc. Bot. France 55: pl. 6, fig. E, 1908.

EXAMINATIONS: *Mont. Glacier National Park* (Frye) 1934.

TYPE LOCALITY: Near Bantry, Ireland (Miss Hutchins).

RANGE: Greenland (476), Labrador (373), N. S. (53.2), Mont. (82), Alta. (46.2), B. C. (46.1), Ida. (81), Wash. (80), Ore. (81); Iceland (13); Eur. (374).

Pearson lists *H. laxifolia* var. *clavuligera* from Greenland, referring to Vahl Syn. Hep. page 147. We do not have the reference.

PLEUROCLADA<sup>20</sup> Spruce, On *Cephalozia* 77, 1882.

*Cephalozia* Dum. Rec. d'Obs. 18, 1835, in part.

Plants in patches or mats or singly among mosses, whitish green, becoming brownish green. Stems prostrate, fleshy, subpinnately branched; branches lateral, formed in place of the ventral half of a lateral leaf. Rhizoids scarce, colorless. Leaves alternate, the dorsal half transversely inserted, the ventral half succubous, rather closely imbricate, much wider than the stem, roundedly concave, 2-lobed; lobes triangular, acute; sinus descending  $\frac{1}{3}$ - $\frac{1}{2}$  the leaf length. Cells of the leaf 20-30  $\mu$ , chlorophyllose; walls thin. Gemmae unknown. Underleaves present throughout, lanceolate, very large, about as large as half a leaf. Plants unisexual. Male bracts 20-30, very concave, 2-lobed for  $\frac{1}{4}$ - $\frac{1}{2}$  their length, with a tooth near the base of the dorsal margin. Female inflorescence terminal; female bracts much larger than the leaves, less deeply divided in proportion to length, ovate; bracteole almost as large as the bracts, broadly lanceolate, unlobed to 2-lobed, often united with one of the bracts toward its base. Perianth clavate or fusiform, 3-angled above, about  $\frac{3}{4}$ -emergent, 2-8 cells thick in lower part, somewhat narrowed at tip to the mouth; mouth crenulate when young by slightly projecting cells, later lacerate to erose. Seta in cross section composed of about 16 large epidermal cells and about 22 smaller interior ones. Sporangium oblong-ovoid, its wall of 2 layers of cells; epidermal layer with nodulose thickenings; inner layer with semiannular thickenings. Spores reddish brown. the name from Gk. *pleura*, side, and *clados*, branch; in reference to the lateral branches.

Leaves 2-lobed for  $\frac{1}{4}$ - $\frac{1}{3}$  their length; underleaves entire or with a

large tooth near base on one or both margins. . . . . 1. *P. albescens*.

Leaves 2-lobed for about  $\frac{1}{2}$  their length; underleaves entire. . . . . 1a. var. *islandica*.

1. *Pleuroclada albescens*<sup>20</sup> (Hook.) Spruce, On *Cephalozia* 78, 1882.

*Jungermannia albescens* Hook. Brit. Jung., pl. 72, and Suppl. pl. 4, 1816.

*Cephalozia albescens* Dum. Rec. d'Obs. 18, 1835.

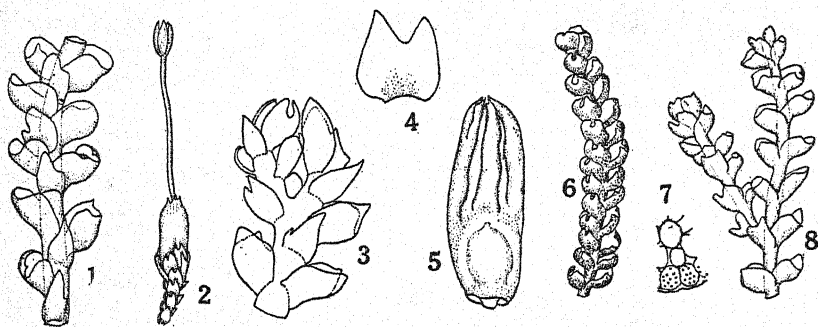
*Cephalozia islandica* var. *albescens* Lindb. Musci Scand. 3, 1879.

*P. albescens* var. *scotica* Spruce, On *Cephalozia* 79, 1882.

<sup>20</sup> plū rō' klā dā.

<sup>20</sup> āl bēs' sēns.

Plants in patches or mats, or singly among mosses, whitish green, or brownish green when old. Stem 0.5-3 cm long, prostrate, or erect among mosses, fleshy, green; cortical cells like the interior ones, not hyaline; normal branches lateral from the axil of an unlobed leaf, subpinnate occasional ones ventral from the axil of an underleaf; flagella wanting. Rhizoids moderately scarce, not tufted, rather long, colorless. Leaves alternate, the dorsal half transversely inserted, the ventral half succubous, not decurrent, distant to mostly imbricate, erect-spreading, simply 2-lobed but adaxially roundedly concave or hemispheric, roundish to quadrate, half embracing the stem dorsally; margin entire except for the apical lobes, or obscurely bluntly angled; lobes broadly triangular, 10-20 cells wide at base, wider than long, incurved; sinus descending  $\frac{1}{4}$ - $\frac{1}{3}$  the leaf length, acute to obtuse; the unlobed leaf subtending a branch, produced partly from the branch and partly from the stem, ovate, acute, subcordate at base. Cells of the leaf middle 20-30  $\mu$ , pellucid; walls slightly thickened; trigones wanting or small; cuticle smooth. Underleaves present almost throughout, very large, smaller than the leaves but nearly as



*Pleuroclada albescens*. 1, Part of plant, ventral view, x 8.5. 2, Female branch, x about 3. 3, Part of plant, ventral view, x 12.8. 4, Leaf, x 22. 5, Perianth, x about 11. 6, Part of stem, dorsal view, x 5.7. 7, Part of cross section of seta, center to surface, x 59. 8, Part of stem, dorsal view, x 5.7. (2, after Hooker; 3, after Evans; 6, after K. Mueller; 7, after Douin; the others after Pearson.)

long, ovate or nearly so, spreading; the tip incurved and not lobed, acute to obtuse; one margin with a tooth near base, or rarely neither or both margins so. Plant unisexual. Female inflorescence terminal on long or short branches which are rhizoidous at base; female bracts  $\frac{1}{4}$ - $\frac{1}{3}$ -bilobed, about 3 times as long as the leaves, free or sometimes united at dorsal bases; lobes triangular, as wide as long, sometimes united dorsally; bracteole united with one bract for about half its length, smaller than the bracts, not lobed or 2-lobed, with 1-3 marginal teeth on each side. Perianth cylindric to clavate, deeply 3-angled, 2-8 cells thick at base de-

pending upon the locality, fleshy; its cells large, elongate, pellucid, acutely to obtusely narrowed to mouth; mouth not tubular, often scarious, later lacerate and erose. Seta in cross section of about 16 large epidermal cells and about 22 distinctly smaller interior ones. Sporangium ovoid. Elaters 10-12  $\mu$  thick; spirals 2, loosely wound, reddish brown. Spores 10-14  $\mu$ , almost smooth, reddish brown. The name is the *L. albescens*, whitish; because the plants are usually whitish green.—On damp banks and earth, between rocks; alpine.

ILLUSTRATIONS: Pearson (433) 2: pl. 75; K. Mueller (409) 2: fig. 26; Ekart (124) pl. 5, fig. 42; Hooker (285) pl. 72, and Suppl. pl. 4; Macvicar (374) 303, figs. 1-3; Meylan (386) fig. 137; Douin, Bull. Soc. Bot. France 55, pl. 6, figs. 5-6, 1908.

EXAMINATIONS: *Alaska*. St. Johns Harbor (Frye) 1913.—*Alta*. Jasper Park (MacFadden 310) 1926.—*Wash.* Mt. Rainier (Piper) 1895; Yakima Park on Mt. Rainier (Rakestraw) 1937.

TYPE LOCALITY: Near the summit of Ben Nevis, Scotland.

RANGE: Greenland (320), Ellsmere Isl. (485.6), Baffin Isl. (485.6), Ill. (529), Mont. (81), *Alta.*, *Alaska* (190), B. C. (371), *Wash.* (81), *Cal.*; *Asia* (308.1); *Eur.* (247.05).

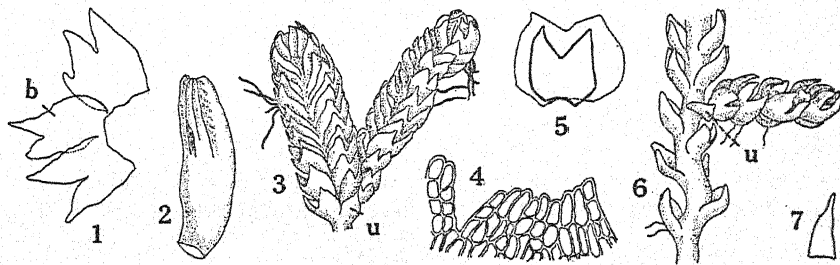
1a. *Pleuroclada albescens* var. *islandica*<sup>21</sup> (Nees) Spruce, On *Cephalozia* 79, 1882.

*Jungermannia islandica* Nees Naturg. Eur. Leberm. 2:29, 1836.

*Cephalozia islandica* Lindb. Musci Scand. 3, 1879.

*P. islandica* Pears., List Canadian Hep., p. 12; Geol. and Nat. Hist. Survey of Canada, 1890.

Plants more slender than in the type. Leaves less concave, almost exactly orbicular, sometimes 2-lobed to the middle. Female bracts less concave, rather narrower than in the type, about  $\frac{1}{3}$ -bilobed. Underleaves entire, often narrower than in the type. Perianth composed of 2-5 layers of cells at base. Male inflorescence extending from the middle to the tip of



*Pleuroclada albescens* var. *islandica*. 1, Female bracts with bracteole (b) between,  $\times 16$ . 2, Perianth,  $\times 12.7$ . 3, Tip of densely leafy plant with the unlabeled leaf (u) subtending the branch,  $\times 13.2$ . 4, Part of mouth of perianth,  $\times 74$ . 5, The leaf (inner) of this variety compared with the leaf (outer) of typical *P. albescens*,  $\times 16$ . 6, Loosely leafy shoot with the unlabeled leaf (u) subtending the branch,  $\times 13.2$ . 7, Underleaf,  $\times 16$ . (2, after Pearson; the others after K. Mueller.)

<sup>21</sup> Is län' dī kä.



branch; male bracts about 28, imbricate, erect, concave,  $\frac{1}{3}$ - $\frac{1}{2}$ -bilobed, occasional ones with a tooth near the base of the dorsal margin; antheridium 1, oblong-obovoid, brown, with rather long stalk. Name from its original discovery in Iceland which the Scandinavians spell Island.

ILLUSTRATIONS: Pearson (433) 2: pl. 76; K. Mueller (409) 2: fig. 27.

EXAMINATIONS: None.

TYPE LOCALITY: Iceland (Hornschuch).

RANGE: Greenland (431); Jan Mayen Isl. (320.4); Iceland (433); Eur. (374).

There is a question whether the variety *islandica* is distinct or grades into the type. Perhaps the best way is to preserve it until more is known about it.

**BLEPHAROSTOMA**<sup>22</sup> Dum. Rec. d'Obs. 18, 1835.

*Jungermannia* section *Blepharostoma* Dum. Syll. Jung. Eur. 65, 1831.

*Phylidium* Mitt., Jour. Linn. Soc. London 5:102, 1861, in part.

*Chaetopsis* Mitt., Jour. Linn. Soc. London 8:53, 1865.

*Blepharostoma* section *Chaetopsis* Schiffn., Engler & Prantl Nat. Pfl.-Fam. 1(3) 1:105, 1895.

Plants small. Stems mostly branched; branches usually originating laterally from the ventral half of a leaf axil and taking the place of the ventral half of that leaf, but sometimes dichotomous. Rhizoids few, colorless or yellowish, at the bases of the underleaves. Leaves alternate, transversely inserted or nearly so, not decurrent, 2-5-lobed, or rarely a single row of cells on poorly developed stems; lobes a single row of cells; sinuses descending nearly to base of leaf. Underleaves present throughout, very like the leaves, sometimes smaller, sometimes with fewer lobes. Plants unisexual, or bisexual with both inflorescences on the same branch. Female inflorescence terminal on a stem or main branch; female bracts rather larger than the leaves, sometimes slightly united with each other at base; bracteoles like the bracts. Perianth free, oblong to cylindric, 3-angled toward tip with one angle ventral, 1 cell thick, contracted at mouth; mouth ciliate. Seta in cross section of 8 large thickly walled epidermal cells and 4 slightly smaller interior cells. Sporangium 4-valved to base, its wall of 2 layers of cells; inner layer with semiannular thickenings. Elaters with 2 spirals.—Name from Gk. *blepharon*, eyelash, and *stoma*, mouth; in reference to the ciliated mouth of the perianth.

Leaf cells 40-112  $\mu$  long; nearly all 2 or more times as long as wide.

Leaves divided into 3-4 capillary segments; leaf cells 40-70  $\mu$  long, 16-30  $\mu$  wide; transverse walls often slightly protuberant.

Leaves divided into 2-3 capillary segments; leaf cells 45-112  $\mu$  long, 25-51  $\mu$  wide; transverse walls often slightly depressed.

Leaf cells about 20  $\mu$ , mostly subquadrate.

1. *B. trichophyllum*.

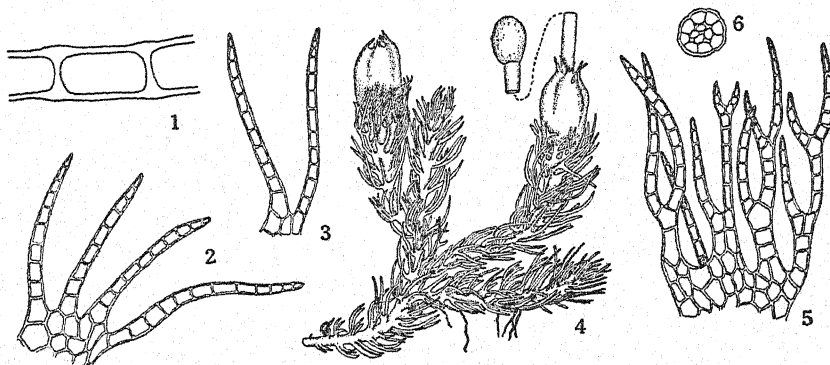
2. *B. arachnoideum*.

2a. var. *brevirete*.

<sup>22</sup> bléf á rós' tō mā.

1. *Blepharostoma trichophyllum*<sup>23</sup> (L.) Dum. Rec. d'Obs. 18, 1835.*Jungermannia trichophylla* L. Sp. Pl. 1135, 1753.*Ptilidium trichophyllum* Mitt., Jour. Linn. Soc. London 5:102, 1861.*Chaetopsis trichophylla* Mitt., Jour. Linn. Soc. London 8:53, 1865.

Plants scattered or in small compact patches, green to yellowish green; leafy branches about 700  $\mu$  wide. Stems 4-20 mm long, ascending to procumbent, flexuous, filiform; branches few to abundant, lateral; epidermal cells 28-96  $\mu$  long and 15-32  $\mu$  wide. Rhizoids few, colorless, long. Leaves alternate, almost transversely inserted but incubously rather than succubously inclined, not decurrent, rather distant to approximate, widely spreading to erect, 3-4-lobed but rarely with 2 or 5 lobes, 500-960  $\mu$  long, about 900  $\mu$  wide, united with the stem for  $\frac{1}{2}$ - $\frac{3}{4}$  the length of the basal cells; lobes each a thick rigid cilium, 8-12 cells long, 500-960  $\mu$



*Blepharostoma trichophyllum*. 1, Part of cilium, showing bulging at transverse walls of cells,  $\times 171$ . 2, Stem-leaf,  $\times 51$ . 3, Underleaf,  $\times 51$ . 4, Part of plant with sporophyte,  $\times 17$ . 5, Female bract,  $\times 51$ . 6, Cross section of seta,  $\times 46$ . (1, original, by Elsie K. Waddingham; 2-5, after K. Mueller; 6, after Douin.)

long; sinuses descending about 0.9 the leaf length, acute to rounded. Cells 40-70  $\mu$  long, 16-32  $\mu$  wide, 1.5-2.5 times as long as wide, transverse walls thickened outwardly so there is a ring appearing as an elevation over the transverse wall; walls somewhat thickened; cuticle striate-granulate. Underleaves resembling the leaves, a little smaller, their lobes about 2 cells shorter, 3-4-lobed on main stems, 2-3-lobed on branches. Plants bisexual or rarely unisexual. Male inflorescence terminal on branches, or just below the female inflorescence, sometimes farther down, spicate; male bracts divided nearly to base into 2-pronged segments, the undivided base about 2 cells high; antheridia 1 or rarely 2, ovoid-globose, small, with stalk nearly as long as the body; paraphyses wanting. Female inflorescences terminal on stems and branches; female bracts larger than

<sup>23</sup> trif kō' fil lūm.

the leaves,  $\frac{3}{4}$ – $\frac{4}{5}$ -divided into 4-6 often several-forked segments which are 2-3 cells wide at base but otherwise of 1 row of cells, base of bract undivided for 4-6 cells high; bracteoles rather smaller than bracts. Perianth free,  $\frac{1}{2}$  or more emergent, cylindric-clavate, 1.4-2.2 mm long, 400-900  $\mu$  wide, obtusely 3-angled in the upper part with one angle ventral, strongly contracted to mouth; mouth wide, ciliate; the cilia rigid, connivent, up to 7 cells long. Calyptra thin, free, half as long as the perianth. Seta 5-12 mm long, in cross section of 8 large epidermal cells and 4 slightly smaller interior ones. Sporangium ellipsoid, 4-valved to base, purplish brown, its wall 2 cells thick; epidermal cells with nodular thickenings on the radial walls; inner layer of wall with imperfect semi-annular thickenings as well as nodular ones. Elaters 130-300  $\mu$  long, 9-11  $\mu$  wide; spirals 2, reddish brown. Spores 14-18  $\mu$ , minutely verruculose, brown. Name from Gk. *thrix*, hair, and *phyllon*, leaf; in reference to the hair-like lobes into which the leaves are divided.—On moist rocky banks, rotting wood or peaty soil.

ILLUSTRATIONS: Hooker (285) pl. 7; Pearson (433) 2: pl. 41; K. Mueller (409) 2: fig. 92; Ekart (124) pl. 4, fig. 27; Schiffner (458) fig. 57 A-E; Jensen (323.5) 179, 2 figs.; Warnstorf (523) 245, fig. 1; Underwood (506) pl. 25; Meylan (386) fig. 170; Sanborn (457) pl. 4, figs. 1-4; Macvicar (374) 341, figs. 1-2; Gil (76) figs. 302-303; Douin, Bull. Soc. Bot. France 55: pl. 9, fig. 39, 1908; Steere (485.5) 46, figs. 1-4.

EXAMINATIONS: *Alaska*, Farragut Bay (Kincaid) 1899; Hidden Inlet (Frye) 1913.—*B. C.* Lewis Island (Frye) 1913.—*Cal.* Hydesville (Frye) 1933.—*N. C.* Roan Mt. (Anderson 4145) 1936.—*N. Y.* Horner Gulf (C. L. Pratt).—*Ore.* Cape Arago (Frye) 1933.—*Wash.* Mt. Rainier (Frye) 1904.—*Wyo.* Centennial (Frye) 1931.

TYPE LOCALITY: European.

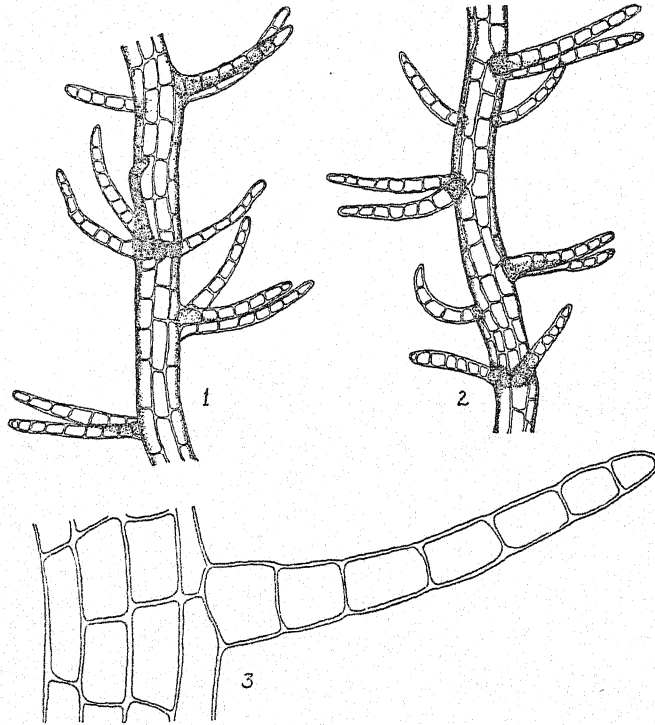
RANGE: Greenland (248), Ellsmere Isl. (485.6), Pim Isl. (56.01), Baffin Isl. (277.2), Devon Isl. (485.6), Melville Peninsula (277.2), District of Keewatin (485.6), Labrador (510), Anticosti (373), Miquelon Isl. (431), Prince Edward Isl. (373), N. S. (53.2), N.B. (369), Me. (369.1), N. H. (359), Vt. (169), Mass. (5), Conn. (140), N. Y. (58), Que. (178), Pa. (338), Ont. (431), Mich. (502), Ill. (529), Wis. (79.3), Minn. (94.1), Manitoba (373), Colo. (175), Wyo. (446), Mont. (81), Alta. (46.2), Yukon (298), Alaska (135), B. C. (371), Ida. (80.1), Wash. (216), Ore. (457), Cal. (84.1), N. Mex. (272), Tenn. (464), N. C. (10), Ky. (218), Va. (217), W. Va. (2.1), D. C. (444), N. J. (212); Mex. (224); Asia (448.2); Eur. (503.1); Azores (2.075); Spitzbergen (524.3); Jan Mayen Isl. (320.4).

## 2. *Blepharostoma arachnoideum*<sup>24</sup> Howe, Mem. Torr. Bot. Club 7:140, 1899.

Plants in dense patches, grayish green to yellowish green. Stems 5-10 mm long, ascending, delicate, flaccid; branches none or few, originating dichotomously or laterally, rarely ventrally; in cross section the cortical cells large and pellucid, the inner cells smaller. Rhizoids wanting to moderately abundant, arising singly or in groups from the bases of the underleaves, colorless or yellowish, long. Leaves alternate, transversely inserted, not decurrent, distant to slightly imbricate, erect-spread-

<sup>24</sup> är" äk nöi' dë üm.

ing, divided to base or nearly so into 2-3 segments, or rarely only 1 segment on poorly developed stems, 500-960  $\mu$  long; segments a single row of cells, sometimes somewhat united at base. Cells about twice as long as wide, 45-112  $\mu$  long, 25-51  $\mu$  wide, hyaline, often slightly contracted at the ring where the lateral walls meet the transverse walls or at least



*Blepharostoma arachnoideum*. 1, Part of plant, dorsal view, x 82. 2, Part of plant, ventral view, x 82. 3, Part of stem and leaf, x 352. (All after Clark and Frye.)

never protuberant there; walls thin or rarely somewhat thickened; trigones wanting; cuticle minutely striate or smooth. Gemmae often present, from the terminal cells of leaf segments at the tip of the stem, formed by the terminal cell dividing into a chain of 10-18 smaller cells each of which is a gemma, giving the tip a powdery appearance, 1-celled, oblong-elliptic, about 25  $\mu$  thick. Underleaves quite like the leaves. Male and female inflorescences as well as sporophyte unknown. Name from Gk. *arachne*, spider, and *eidos*, like; in reference to the spider-like appearance produced by the many long narrow leaf segments.—On rotting logs in damp woods.

ILLUSTRATIONS: Clark & Frye (81) 130, figs. 1-3.

EXAMINATIONS: *B. C.* Port Renfrew on Vancouver Island (Gibbs) 1901.—*Cal.* North Fork of Little River in Mendocino County (Howe) 1896.—*Mont.* Piegan Pass trail from Many Glaciers in Glacier National Park (Frye) 1928.—*Wash.* Lewis County (Flett 2714) 1905.

TYPE LOCALITY: Russian Gulch near Mendocino, Mendocino County, California (Howe 703).

RANGE: *Mont.* (81), *B. C.* (46.1), *Wash.* (81), *Ore.* (457), *Cal.* (296).

This is not a well marked species. Since its reproduction is unknown, we feel it should have been left a variety until proved to be sufficiently distinctive. Most of the characters which distinguish it grade into those of *B. trichophyllum*. If its reproductive features are found to agree with those of *B. trichophyllum* it must be regarded as a mere variety.

2a. *Blepharostoma arachnoideum* var. *brevirete*<sup>25</sup> (Bryhn & Kaal.) n. comb.

*B. trichophyllum* var. *brevirete* Bryhn and Kaal., Rept. 2nd Norwegian Arctic Exped. in the "Fram" 1898-1902, 11:46, 1906.

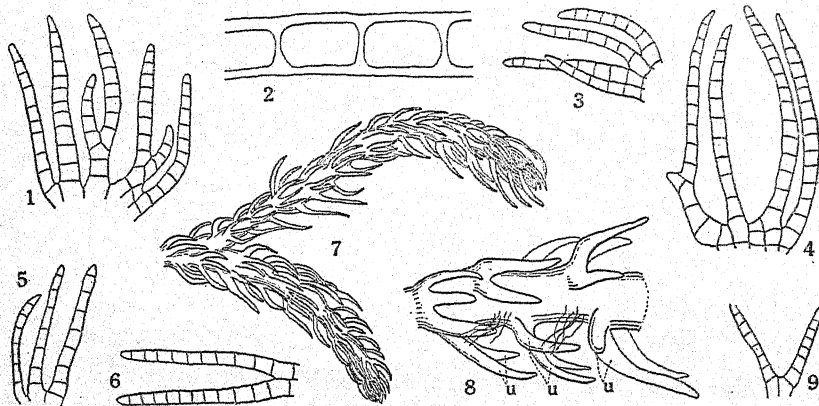
Leaves about the same length as in the type but more remote. Cells of well developed leaves mostly subquadrate, about 20  $\mu$ . The name from *L. brevis*, short, and *rete*, net; in reference to the smaller size of the leaf cells as compared with those of *B. trichophyllum*.

ILLUSTRATIONS: None.

EXAMINATIONS: *Alta.* Miette Hot Springs in Jasper National Park (Frye & Frye 2921) 1940.

TYPE LOCALITY: Framshavn near the S.E. corner of Ellesmere Island may be so considered. About Lat. 76° 23' N., Long. 80° 49' W.

RANGE: Ellesmere Island (56.01), *Alta.*



*Blepharostoma arachnoideum* var. *brevirete*. 1, Leaf, x 60. 2, Part of leaf lobe, x 350. 3-5, Leaves, x 60. 6, Underleaf, x 60. 7, Part of a plant, x 26. 8, Part of shoot showing underleaves (*u*), x 80. 9, Underleaf, x 60. (All original, by Elizabeth Curtis.)

<sup>25</sup> brě vř rě' tē.



*PTILIDIUM*<sup>26</sup> Nees Naturg. Eur. Leberm. 1:95, 1833.

*Jungermannia* L. Sp. Pl. 1131, 1753, in small part.

*Blepharozia* Dum. Rec. d'Obs. 16, 1835.

Plants usually in dense tufts, yellowish to brownish green or reddish brown. Stems pinnate to bipinnate or irregularly branched; branches lateral, from the ventral half of a leaf axil and taking the place of the ventral half of that leaf, not attenuate, not flagelliferous at tip. Rhizoids none to few, short. Leaves alternate, transversely inserted or nearly so, not decurrent, simply 3-5-lobed, the portion homologous with the dorsal half the larger; margin of leaf and its lobes with few to very many long cilia, or rarely some leaves without them. Underleaves very similar to the leaves but about half their length. Plants unisexual. Male inflorescence either terminal or farther down on the main stem or a large branch. Female inflorescence terminal on stem or large branch, or apparently on a lateral branch by formation of a lateral innovation at tip. Perianth long-emergent, free from the bracts, swollen, fusiform or cylindric to clavate or pyriform, indistinctly plicate at the mouth, constricted at tip; mouth ciliate. Seta fleshy, about 14 cells in diameter, in cross section the interior cells larger than the cortical ones. Sporangium ovoid. Elaters with 2-3 spirals. Name from Gk. *ptilidion*, a small feather; from the many segments of the leaves.

The genus needs careful study. Whether a liverwort grows on the ground or on a log does not impress us as a species character because in a wet region like the Northwest Coast the substratum has less significance. The variations in the leaves on the same plant are of importance. The sporangia are so rare that their details are not well known.

Leaves with few or no cilia at margin; underleaves lobed to about  $\frac{1}{3}$  their length; leaf sinuses descending  $\frac{1}{2}$ - $\frac{5}{6}$  the leaf length. ....

1. *P. californicum*.

Leaves with many cilia at margin; underleaves lobed  $\frac{1}{3}$ - $\frac{1}{2}$  their length.

Plants usually on soil, yellowish or tawny, rarely reddish brown; largest lobe of leaf 15-20 cells wide at base, sinuses descending  $\frac{1}{3}$ - $\frac{1}{2}$  the leaf length; gemmae 2-4-celled. ....

2. *P. ciliare*.

Plants usually on wood or rock, reddish brown; largest lobe of leaf 6-10 cells wide at base, sinuses descending about  $\frac{3}{4}$  the leaf length; gemmae 1-2-celled. ....

3. *P. pulcherrimum*.

1. *Ptilidium californicum*<sup>27</sup> (Aust.) Underw. & Cook, Hep. Amer. Exsic. No. 69, May, 1890.

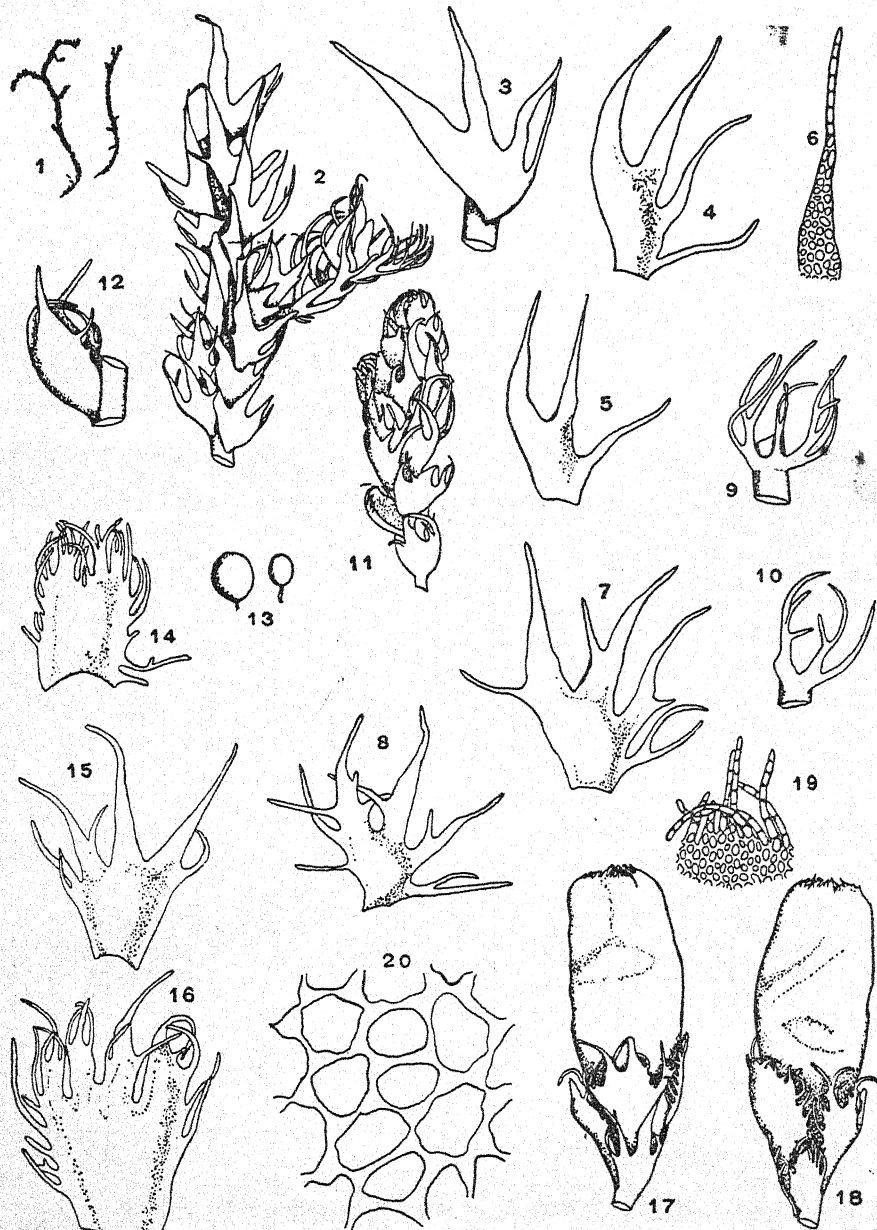
*Lepidozia californica* Aust., Bull. Torr. Bot. Club 6:19, 1875.

*Mastigophora californica* Aust., Bull. Torr. Bot. Club 6:302, 1879.

Plants usually in dense appressed mats, bright green to yellowish green or reddish brown. Stems mostly 1-5 cm long, decumbent, subfiliform and flaccid to somewhat stout, sparingly irregularly branched or

<sup>26</sup> tī li' dī ūm.

<sup>27</sup> kál ī fōr' nī kūm.



*Ptilidium californicum*. 1, Plants, x 1. 2, Part of plant, x 12. 3, Stem leaf, dorsal view, x 23. 4, Stem leaf, ventral view, x 23. 5, Stem leaf, 3-cleft, ventral view, x 23. 6, Typical apex of leaf-segment, x 41. 7, Stem leaf, ventral view, x 23. 8, Branch leaf, ventral view, x 23. 9-10, Underleaves, x 23. 11, Male inflorescence, x 12. 12, Male bract, x 23. 13, Antheridia, x 23. 14, Bracteole, x 23. 15, Underleaf just beneath the bracteole, x 23. 16, Bracteole, x 23. 17, Ventral view of perianth and female bracts, x 12. 18, Dorsal view of perianth and female bracts, x 12. 19, Portion of mouth of perianth, x 41. 20, Leaf cells, x 225. (All after Howe.)

rarely subpinnate. Rhizoids none or few, short. Leaves alternate, transversely inserted, not decurrent, loosely imbricate, erect-spreading, rather simply 3-4-lobed, more or less triangular in general outline, quite convex on the back; margin of leaf or its lobes commonly with a few long cilia; lobes lanceolate to linear-lanceolate, filiformly attenuate, unequal, the dorsal the larger; the two dorsal ones homologous with the dorsal half of an equally bilobed leaf, the two ventral ones with the ventral half; ventral 1-2 lobes somewhat inflexed; sinuses descending  $\frac{1}{2}$ – $\frac{5}{6}$  the leaf length, rounded. Cells of the general leaf middle 30–60  $\mu$ , 5-6-angled with roundish cell cavity; walls thin to rather thick; trigones large to bulging; cuticle smooth. Underleaves present throughout, much smaller than the leaves, 2-3-lobed, commonly somewhat wider than the stem, the lobes long ciliate; the sinuses descending to about  $\frac{7}{8}$  the underleaf length, rounded. Plants unisexual. Male plants usually more slender; male inflorescence terminal on a stem or main branch; male bracts very similar to the leaves, more closely imbricate, more convex dorsally; antheridia 1-2, ovoid or ellipsoid, with stalks shorter than the body when mature. Female branch short, lateral, bearing 2-4 leaves plus the bracts; female bracts slightly larger than the leaves, more ciliate than the leaves; bracteole free from the bracts or rarely united with one or both, less deeply divided than the bracts, with more cilia, similar to the underleaves. Perianth cylindric-obovoid, or oblong-fusiform from an obconic base, roundedly narrowed to the mouth; mouth wide, ciliate, slightly plicate. Seta moderately long. Sporangium ovoid, with 4 valves, wall with nodular thickenings in the epidermis and semiannular ones in the innermost layer. Elaters 120–225  $\mu$  long, 7–10  $\mu$  wide, contorted, subobtuse; spirals 2 or rarely 3. Spores 21–30  $\mu$ , densely minutely punctate, brown. So named from the state from which it was first reported.—On trees in rather dry places.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 105, 1899; Clark & Frye (81) 134, figs. 1–20; Sanborn, Univ. of Oregon Publ. Pl. Biol. 1(1): pl. 4, figs. 5–8, 1929; Schiffner, Hedwigia 50:151, figs. 17–19, 1911.

EXAMINATIONS: *Alaska*. Hidden Inlet (Frye) 1913; Juneau (Mehner) 1904; Kodiak (Mylroie) 1910.—*B. C.* Grand Central Lake (Frye) 1923.—*Idaho*. Moscow Mt. (Clark) 1925.—*Mont.* Garrison (Frye) 1929; Glacier National Park (Frye) 1929; Wolf Creek (Frye) 1928.—*Ore.* Mt. Hood (Foster) 1907.—*Wash.* Darrington (Bailey) 1929; Elwha River Valley (Frye) 1907; Friday Harbor (Clark) 1923; Spirit Lake (Rakestraw) 1937.

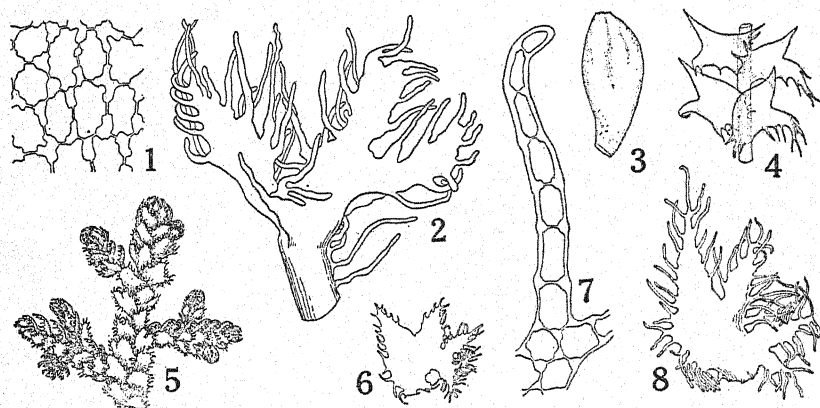
TYPE LOCALITY: California, likely Mendocino or Humboldt counties (H. Boler).

RANGE: *Alaska* (173), *B. C.* (296), *Mont.* (81), *Ida.* (281), *Wash.* (276), *Ore.* (457), *Cal.* (491).



2. *Ptilidium ciliare*<sup>28</sup> (L.) Hampe Prodr. Fl. Hercyn. 76, 1836.*Jungermannia ciliaris* L. Sp. Pl. 1134, 1753.*Blepharozia*<sup>29</sup> *ciliaris* Dum. Rec. d'Obs. 16, 1835.

Plants scattered among mosses or in compact tufts or patches, reddish brown; leafy branches obtuse, especially those from near stem tip, 2-3 mm wide. Stems 2-8 cm long, procumbent or erect, the branching shortly pinnate and often bipinnate; flagella wanting; in cross section the epidermal layer somewhat smaller and thick walled. Rhizoids scarce, short. Leaves alternate, incubous but almost transversely inserted, not decurrent, approximate to imbricate, spreading to erect-spreading, divided into 2 chief lobes of which the dorsal one is the larger and both again



*Ptilidium ciliare*. 1, Cells of leaf showing trigones,  $\times 151$ . 2, Leaf,  $\times 34$ . 3, Perianth,  $\times 3.9$ . 4, Portion of stem, dorsal view,  $\times 8.5$ . 5, Plant,  $\times 4.2$ . 6, Leaf,  $\times 8.8$ . 7, Cilium of leaf,  $\times 151$ . 8, Leaf,  $\times 24$ . (3-4, after Pearson; 5-6, after K. Mueller; the others original, by Elizabeth Curtis.)

bilobed thus making the leaf unequally 4-lobed, roundish-subquadrate, about half clasping the stem, convex on the back; margin with many cilia; cilia long, some curved, others straight, about  $300 \mu$  long; lobes successively shorter from the dorsal to the ventral side, acute, the 2 ventral lobes directed forward making the leaf somewhat complicately lobed; the dorsal lobe 15-20 cells wide at base; sinuses descending  $\frac{1}{3}$ - $\frac{1}{2}$  the leaf length, rounded. Cells of the leaf middle  $28$ - $36 \mu$ , of the margin hardly smaller, of the base a little larger, roundish-oblong; walls thin between trigones; trigones bulging; cuticle punctate. Gemmae sometimes present, on the leaf margins, 2-4-celled, green. Underleaves about half the area of the leaves, rounded-quadrate, appressed, irregularly 2-4-lobed, ciliate; their cilia long, often forked. Plants unisexual. Male plants much smaller

<sup>28</sup> sil i ā' rē.<sup>29</sup> Spelled *Blephoragia* in Ann. Rept. Geol. Surv. Indiana 8-10:238, 1878. Evidently it is a misinterpretation of a hand-written label.

than the female ones, in separate tufts or intermingled with the female plants, procumbent, irregularly bipinnate; male inflorescence terminal on chief branches, or rarely farther down; male bracts in several pairs, smaller than the leaves, transversely inserted, closely imbricate, convex dorsally, ventricose, unequally 3-4-lobed, the margin with incurved cilia; antheridia 1-2, large; paraphyses wanting. Female inflorescence terminal on main branches or stems, through innovation appearing to be on a short lateral branch; female bracts rounded-ovate, much like the leaves, convex dorsally, applied to the perianth, 2-4-lobed for  $\frac{1}{4}$ - $\frac{1}{3}$  the length, margins of the bracts and their lobes with many long cilia. Perianth pyriform, largely emergent, obtusely plicate toward tip, contracted to mouth; mouth 4-5-lobed and ciliate. Seta long, yellowish. Sporangium subglobose, dark brown, its wall 4 cells thick; epidermal cells polygonal, with nodular thickenings; innermost layer of wall cells with semiannular thickenings. Elaters 6-7  $\mu$  thick; spirals 2, reddish brown. Spores 25-33  $\mu$ , finely papillose, brown. So named from its ciliate leaves.—On wet and mostly peaty soil; on bark and rotting wood.

ILLUSTRATIONS: Pearson (433) 2: pl. 38; Hooker (285) pl. 65; Warnstorf (523) 266, fig. 2; Ekart (124) pl. 5, fig. 36; K. Mueller (409) 2: figs. 99 and 100a; Macvicar (374) 353, figs. 1-4; Jensen (323.5) 179, 2 figs.; Underwood, Gray's Manual, Ed. 6, pl. 24, 1884; Leitgeb, Unters. Leberm. 2: pl. 3, figs. 19-31, 1875; Meylan (386) fig. 174 A-B; Gil (76) fig. 307a.

EXAMINATIONS: *Alaska*. Juneau (Mehner) 1905; Taku (Frye) 1913.—*N. Y.* Elmira (Barbour 888) 1900.

TYPE LOCALITY: European.

RANGE: Greenland (501), Baffin Isl. (485.6), Melville Peninsula (277.2), Digge Isl. (373), Nottingham Isl. (431), Akpatok Isl. in Hudson Straits (444.1), Southampton Isl. in Hudson Bay (485.6), District of Keewatin (272.2), Labrador (504), Anticosti Isl. (431), Miquelon Isl. (431), N. S. (53.2), N. B. (373), Me. (369.1), N. H. (353), Vt. (145), Mass. (140), R. I. (140), Conn. (212), Va. (127), D. C. (444), N. Y. (104.1), Que. (522.1), Pa. (338), Ont. (373), Ind. (454), Mich. (419.1), Ill. (529), Wis. (454), Minn. (212), Iowa (469), Manitoba (373), Mont. (328), Alta. (46.2), Mackenzie District (485.6), Yukon (501), Alaska (135), B. C. (508); Asia (308.1); Eur. (506).

### 3. *Ptilidium pulcherrimum*<sup>80</sup> (Weber) Hampe Prodr. Fl. Hercyn. 76, 1836.

*Jungermannia pulcherrima* Weber Spic. Fl. Goettingensis 150, 1778.

*Jungermannia leersii* Roth Tent. Fl. Germ. 2:402, 1800.

*Jungermannia hoffmanni* Wallr. Fl. Crypt. Germ. 1:51, 1831.

*P. ciliare* var. *wallrothianum* Nees Naturg. Eur. Leberm. 3:120, 1838.

*Blepharozia hoffmanni* Cogn., Bull. Soc. Bot. Belgique 10:25, 1872.

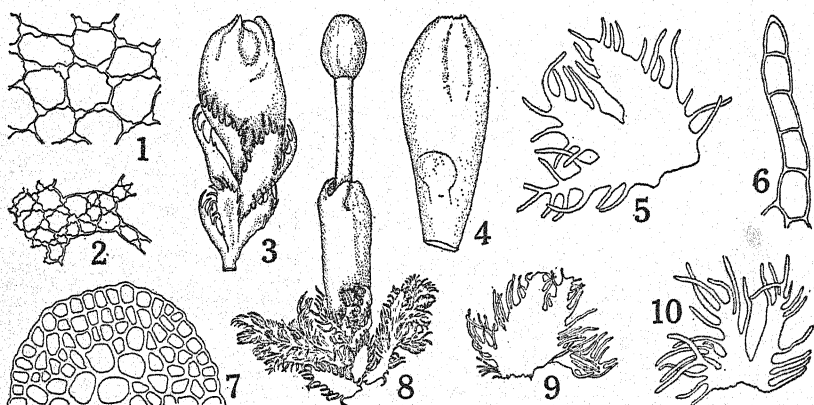
*Blepharozia pulcherrima* Lindb. Musci Scand. 5, 1879.

*P. ciliare* var. *pulcherrima* Warnst. Krypt.-Fl. Mark Brandenburg 1:260, 1902.

Plants in very dense patches, yellowish green or tawny to reddish brown; leafy branches rounded at tip. Stems prostrate with ascending

<sup>80</sup> pül kër' i müm.

tips, in an entangled mass below, branches irregular, many, short. Rhizoids few, at base only. Leaves alternate, incubous but almost transverse, not decurrent, densely imbricate, erect or nearly so, somewhat complicatedly 2-lobed, the dorsal half the larger and each half again 2-3-lobed so the leaf is 4-5-lobed, rounded in general form, embracing the stem. Mar-



*Ptilidium pulcherrimum*. 1, Leaf cells, showing trigones,  $\times 151$ . 2, Cells from margin of leaf,  $\times 71$ . 3, Young perianth,  $\times 112$ . 4, Nearly mature perianth,  $\times 112$ . 5, Leaf from stem,  $\times 21.6$ . 6, Cilium,  $\times 136$ . 7, Half the cross section of a stem,  $\times 78$ . 8, Portion of a stem with sporophyte,  $\times 5.7$ . 9, Leaf,  $\times 12.3$ . 10, Leaf,  $\times 17.6$ . (4, after Pearson; 2-3, 5, 7-8, 10, after K. Mueller; all others original, by Elizabeth Curtis.)

gins of leaf and its lobes with many cilia of which most are curved and 400-500  $\mu$  long; lobes quite unequal but the main dorsal lobe the largest, acute, 6-10 cells wide at base; sinuses descending about  $\frac{3}{4}$  the leaf length including the cilia, rounded to acute. Cells of the leaf middle 30-35  $\mu$ , of the margin hardly smaller, of the base slightly larger; walls thin between trigones; trigones bulging; cuticle smooth or punctate. Gemmae occasional, on the leaf margin, spherical to ovoid, 1-2-celled. Underleaves smaller than the leaves, much like them, irregularly 3-4-lobed, the sinuses descending  $\frac{1}{3}$ - $\frac{1}{2}$  the length. Plant unisexual. Male inflorescence terminal usually on the main axis, or farther down; male bracts lobed about  $\frac{1}{2}$  to base, lobes wider than in the leaves, with more and shorter cilia than the leaves; male bracteole like the underleaves. Female bracts narrower than in *P. ciliare*, the lobes wider than those of the leaves, the margin with more and longer cilia than the leaves. Perianth less swollen than in *P. ciliare*, cylindric to clavate, with 3 bladder-like folds or plicae toward tip, contracted at mouth; mouth toothed and with bristle-like cilia. Seta 5-7 mm long, fleshy, in cross section about 14 cells wide, the cortical cells like those of the second and third rows, toward the center the cells larger,

all somewhat thickened at the angles. Sporangium ovoid. Name the *L. pulcherrimum*, the most beautiful; on account of the many long cilia on the leaves.—On rocks or trees, or on ground.

ILLUSTRATIONS: K. Mueller (409) 2: figs. 98 and 100b; Pearson (433) 2: pl. 39; Macvicar (374) 355, figs. 1-3; Meylan (386) fig. 174 C-D; Gil (76) fig. 307b; Steere (485.5) 42, figs. 4-5.

EXAMINATIONS: *Alaska*. Juneau (Mehner) 1905; Kiana (Orah Dee Clark) 1937.—*Alta*. Banff National Park (Rakestraw) 1937; Waterton Park (Rakestraw) 1937.—*B. C.* Summit Camp in Kootenay National Park (Rakestraw) 1937.—*Ida*. Moscow (Clark) 1923; Priest Lake (Piper); Sand Point (Rakestraw) 1937.—*Ill*. Morton (Drexler 1215) 1937; Urbana (Drexler 1112) 1937.—*Mich*. Cheboygan (Woollett) 1923; Negaunee in Marquette County (Nichols) 1935.—*Mont*. Glacier National Park (Rakestraw) 1937; Yakt (Frye) 1929.—*Ont*. Lake Nipigon (Macoun 63) 1884.

TYPE LOCALITY: European.

RANGE: Newfoundland (433), N. S. (370), N. B. (369), Me. (145), N. H. (3), Vt. (169), Mass. (232), R. I. (155) Conn. (212), N. Y. (58), Que. (522), Ont. Pa. (237), Mich. (415), Ill. Wis. (98), Minn. (338), Iowa (88), Mont. (338), Alta. (46.2), Alaska (173), B. C., Wash. (81), Ida. (80.1), Ky. (218), Tenn. (465.2), N. C. (43), Va. (212), W. Va. (2.1), Md. (444); Asia (308.1); Eur. (503.1); Spitzbergen (524.3).

TRICHOLEA<sup>21</sup> Dum. Comm. Bot. 113, 1822.

*Tricholea* Dum. Syll. Jung. Eur. 66, 1831.

*Trichocolea* Nees Naturg. Eur. Leberm. 3:103, 1838.

Plants whitish green to yellowish green, large. Stems one or more times pinnately branched; dorsal side of main stem densely covered with branched chlorophyllose paraphyllia; branches replacing the ventral half of a leaf; flagella wanting. Rhizoids wanting or a few at base. Leaves alternate, succubous but nearly transversely inserted, palmately lobed almost to the base; lobes numerous, divided into many ciliolate segments. Underleaves similar to the leaves but smaller, twice bifid nearly to base. Plants unisexual. Male inflorescence terminal on the chief branches; male bracts similar to the leaves. Female inflorescence terminal on a main stem or elongate lateral branch but becoming axillary or lateral through innovations; female bracts capillary. Perianth wanting. Calyptra fleshy, clavate, erect, a prolongation of the stem tissue surrounding the egg and young sporophyte, with sterile archegonia near its tip, covered with paraphyllia which, in part, are probably female bracts. Seta comparatively long, in cross section with 4-5 cortical layers of small cells and larger thin walled interior cells, becoming hollow by the rupture of the interior cells. Sporangium oblong, the wall of numerous layers of cells; the epi-

<sup>21</sup> trī kō' lē ä. From the synonymy the history of the name is evident. In 1874 Dumortier (Hep. Eur. 111) explains that he chose the contracted form *Tricholea* instead of *Trichocolea* for the sake of a more euphonious name. It was not a typographical error; it was deliberately selected. He was privileged to choose a name regardless of whether its significance is clear, vague or wholly wanting. To be logical we should return to it.



dermal cells larger than the others and without thickenings. Elaters with 2 spirals. Name from Gk. *thrix*, hair, and *koleos*, female sheath; in reference to the hairy fleshy calyptra.

1. *Tricholea tomentella*<sup>82</sup> (Ehrh.) Dum. Comm. Bot. 113, 1822.

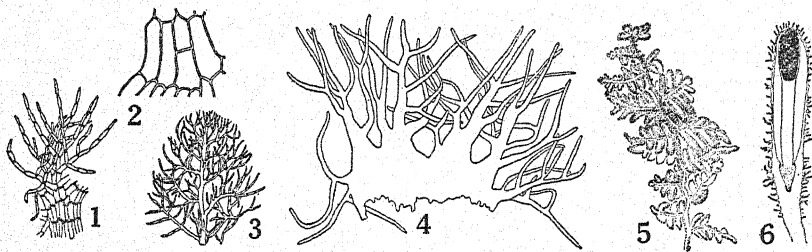
*Jungermannia tomentella* Ehrh. Beitr. 2:150, 1785.

*Thricolea tomentella* Dum. Syll. Jung. Eur. 67, 1831.

*Trichocolea tomentella* Nees Naturg. Eur. Leberm. 3:103, 1838.

*Trichocolea biddlecomiae* Aust., Bot. Gaz. 3:6, 1878.

Plants in patches or mats, pale green to creamy in color. Stems 5-12 or more cm long, procumbent to suberect, flexuose, yellowish green, brownish below, 2-3-pinnate; branches lateral, spreading to erect-spreading, tips of chief branches and of stem thickened; paraphyllia more or less numerous on the ventral side and lateral parts, simple or branched, cilia-like; stem in cross section 12-16 cells thick, the outer 2-3 rows smaller and somewhat more thickly walled. Rhizoids few, at base only. Leaves alternate, succubous but almost transversely inserted, not decurrent, distant or approximate to imbricate, spreading, simply and unequally bilobed with the lobes again lobed, thus the leaf about 4-lobed, rounded



*Tricholea tomentella*. 1, Part of a leaf,  $\times 30$ . 2, Cells at base of cilia,  $\times 84$ . 3, Tip of branch,  $\times 19.5$ . 4, Leaf,  $\times 29$ . 5, Upper part of plant,  $\times 1$ . 6, Longitudinal section of perianth with immature sporophyte,  $\times 30$ . (1, 3, 6, after K. Mueller; the others original, by Elizabeth Curtis.)

to reniform in general outline, about 1 mm long and 1.3 mm wide, half embracing the stem; margin of leaf and its lobes with many long cilia; dorsal half of leaf the larger and the second lobe from the dorsal side the largest of the four, all lobes acuminate; sinus descending very nearly to the base of the leaf, acute to rounded. Cells of the leaf middle about 50-80  $\mu$  long and 20-40  $\mu$  wide, of the tips somewhat narrower; of the undivided base about 70  $\mu$  long and 20  $\mu$  wide; walls thin; trigones wanting; cuticle striate-punctate. Underleaves less than half the area of the leaves, roundish in general outline, 4-lobed, otherwise very much like the leaves. Plants unisexual. Male inflorescence terminal on chief

<sup>82</sup> tồ mền tểi' lă.



branches; male bracts much like the leaves but more connivent; antheridia usually 2, globose, large. Female inflorescence on chief branches or stems, apical, becoming axillary or lateral through innovations. Perianth wanting. Calyptra cylindric-clavate, erect, 6-8 cells thick, with sterile archegonia near its tip, covered with paraphyllia; paraphyllia branched, capillary, coarsely striate-punctate. Seta long, about 500  $\mu$  thick; in cross section about 20 cells thick; cortical cells about 140, small, dark; interior ones gradually larger. Sporangium oblong, large, purplish brown, the wall of 6-8 layers of cells; epidermal layer of large colorless cells without thickenings; innermost layer with annular thickenings on the tangential walls; intermediate layers with thickenings on the radial walls. Elaters about 1 mm long, 10-13  $\mu$  thick; spirals 2, reddish brown. Spores 10-15  $\mu$ , smooth, reddish brown. The name the diminutive of *L. tomentum*, hair; probably in reference to the paraphyllia on the calyptra or on the stem.—In marshes and springs, and on wet banks or rocks.

ILLUSTRATIONS: Pearson (433) 2: pl. 40; Hooker (285) pl. 36; K. Mueller (409) 1: fig. 94; also 2: figs. 100-103; Ekart (124) pl. 6, fig. 49; Sullivant (498) pl. 8; Underwood (506) pl. 25; Carrington, Brit. Hep. pl. 10, fig. 32, 1874-1876; Meylan (386) figs. 175-176; Dumortier, Syll. Jung. Eur. pl. 1, fig. 8, 1831; Dumortier, Hep. Eur. pl. 3, fig. 29, 1874; Macvicar (374) 356, figs. 1-3; Jensen (323.5) 179, 2 figs.; Warnstorff (523) 266, fig. 3; Gil (76) figs. 304-306; Leitgeb, Leberm. 2: pl. 3, figs. 1-18, 1875; Steere (485.5) 42, figs. 1-3.

EXAMINATIONS: Ind. Turkey Run State Park (Drexler 1414) 1938.—Mich. Cheboygan County (Woollett) 1923; Riese's Bog in Cheboygan County (Wynne 1187) 1939.—N. C. Cullasaja River (Welch 2607) 1936; Durham (Blomquist) 1932; Hot Springs (Taylor 2821) 1931.—Pa. Sayre (Barbour 35) 1900.

TYPE LOCALITY: European.

RANGE: Newfoundland (212), Miquelon Isl. (373), N. S. (53.2), Me. (369.1), N.H. (359), Vt. (169), Mass. (140), R. I. (203), Conn. (212), N. Y. (104), Que. (178), Pa. (338), Ont. (431), Ohio (504), Ind. (512.1), Mich. (331.1), Wis. (94.1), Tenn. (464), N. C. (43), Va. (127), Ky. (218.2), W. Va. (386.5), Md. (444), D. C. (343); Tahiti (406); Samoan Isls. (448.01); Asia (404); Eur. (394.1).

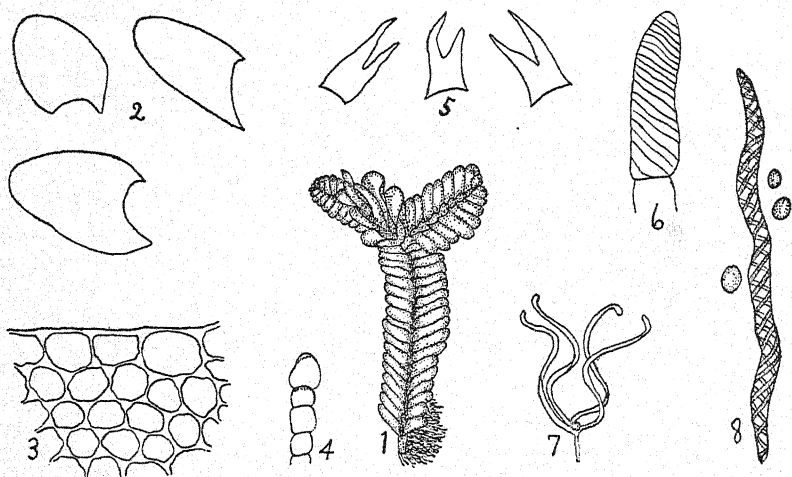
GYROTHYRA<sup>33</sup> Howe, Bull. Torr. Bot. Club 24:201, 1897.

Leaves alternate, succubous, entire. Branches from the ventral half of the leaf axil. Underleaves present nearly throughout, bifid; segments narrowly lanceolate to subulate. Trigones distinct. Plants unisexual. Male inflorescence terminal, spicate. Female inflorescence terminal on a main stem. Perianth coherent with the bases of the female bracts and with the concave stem tip to form a perigynium; perigynium not rhizoidous, at maturity at right angles to the stem tip. Seta with goblet-shaped base. Sporangium long-cylindric, dehiscing spirally by 4 long and slender valves, its wall of 2 layers of cells; cells of both layers without thickenings on the walls. Name from Gk. *gyros*, twisted, and *thyra*, door; in reference to the spiral valves of the sporangium.

<sup>33</sup> jŷ rō thŷ' rā.

1. *Gyrothya underwoodiana*<sup>24</sup> Howe, Bull. Torr. Bot. Club 24:202, 1897.

Plants mostly in compact patches or extensive mats, light green; leafy branches 2-4 mm wide. Stems 1-2 cm long, 500-650  $\mu$  thick, often flattened dorsiventrally, creeping, slightly ascending at tip, about 15 cells wide in cross section, subsimple or with few branches from the ventral half of the leaf axil, the female plant innovating from near base of perigynium. Rhizoids in tufts from cushion-like elevations, numerous, not near apex of stem, light brown to purplish. Leaves alternate, quite succubous, scarcely decurrent dorsally, rather closely imbricate, spreading, not lobed, lingulate to oval, concave at base, decurved, 1.7-4 mm long, 1.4-2 mm wide; apex rounded; margin entire. Cells of leaf middle 25-70



*Gyrothya underwoodiana*. 1, Female plant, x2.5. 2, Three leaves, x9. 3, Cells along leaf margin, x112. 4, Cross section through leaf margin, x108. 5, Three underleaves, x12. 6, Surface view of unruptured sporangium showing spiral valves, x50. 7, Ruptured sporangium, moist, x6. 8, Elater and three spores, x137. (All after Clark & Frye.)

$\mu$  and regularly 5-6-sided, of the base oblong and larger but 5-6-sided; those of the marginal row 1-2 times the area of the second row, thicker dorsiventrally, oblong to quadrate, making a more or less distinct border; walls rather thin between the trigones; trigones conspicuous, often bulging into the cells; cuticle minutely papillose. Gemmae occasionally present, at tips of slender plants, 10-24  $\mu$ , unicellular. Underleaves present throughout but hidden by rhizoids below, 0.6-1 mm long, lanceolate to lingulate but  $\frac{1}{2}$ - $\frac{2}{3}$  bifid; lobes lanceolate to subulate, usually ending in a single row of cells; sinus acute. Plants unisexual; both inflorescences terminal. Male plants intermingled with the female, more slender; male

<sup>24</sup> ün' dēr wōōd ī ā' nā.

inflorescence spicate; male bracts smaller than the leaves, 6-12, saccate, appressed, the apex recurved to spreading or of the upper erect; antheridia 1-6 in an axil, ellipsoid to pyriform, about  $240\ \mu$  long and  $150\ \mu$  wide, with stalks about  $80\ \mu$  long. Female inflorescence terminal on a main stem; female bracts similar to the leaves, erect and concealing the perianth or their tips spreading and exposing it; bracteole inconspicuous, sometimes subentire and adherent to the base of the bracts. Perianth united with the bracts for  $\frac{1}{2}$ - $\frac{2}{3}$  its length, with the bracts and hollowed out stem tip forming a sac-like perigynium; free part subtubular to narrowly conic, 3-5 cells thick where narrowed to mouth, 2 cells thick at mouth; mouth tubular, narrow, crenulate. Perigynium erect or ascending, at right angles to the stem at maturity, thick walled, 3-4 mm long including the perianth, 1-1.5 mm thick, without rhizoids except from the bases of the female bracts, purplish ventrally, its wall 5-20 cells thick. Calyptra fleshy,  $\frac{1}{8}$ - $\frac{1}{4}$ -free at maturity, 3-6 cells thick. Seta 1.5-2 cm long, with goblet-shaped base; in cross section of about 16 large epidermal cells and about 31 much smaller interior cells, in 3-4 layers. Sporangium long-cylindric; walls 2 cells thick; epidermal cells 2-3 times as long as wide, without thickenings; cells of inner layer of wall 2-4 times as long as wide, without thickenings, transverse cell walls slightly thicker than the longitudinal ones; valves 4, very slender, 3.3-6 mm long,  $130$ - $170\ \mu$  wide, forming spirally on the sporangium, on the mature open sporangium widely spreading when dry but contorted when moist. Elaters  $210$ - $420\ \mu$  long, 12-15  $\mu$  wide, acute or subobtus; spirals 2 or rarely 3. Spores about  $12\ \mu$ , minutely papillate. Named in honor of Dr. Lucien M. Underwood.—On damp rocks and dirt banks.

ILLUSTRATIONS: Howe, Bull. Torr. Bot. Club 24: pls. 302-303, 1897; reprinted in Mem. Torr. Bot. Club 7: pls. 102-103, 1899; Clark & Frye (81) 66, figs. 1-8.

EXAMINATIONS: *Alaska*. Augustine Bay (Frye) 1913.—*Cal.* Crescent City (Frye) 1933; Eureka (Howe) 1896; Smith River (Rakestraw) 1936; Weitchpek (Frye) 1933; Willow Creek (Rakestraw) 1936.—*Ore.* Brookings (Frye) 1933; Nes-kowin (Clark & Frye Hep. Exsic. 36) 1936; Port Orford (Rakestraw) 1936.—*Wash.* Bowmans Creek in Clallam County (Svihla 263) 1931; Hamilton (Foster) 1905; Ilwaco (Frye) 1908; Mill Creek in Cowlitz County (Rakestraw) 1936; Mt. Constitution on Orcas Island (Wentworth) 1923.

TYPE LOCALITY: Eureka, California (M. A. Howe) June, 1896.

RANGE: Alaska (173), B. C. (373), Wash. (81), Ore. (457), Cal. (296).



MARSUPELLOIDEAE<sup>85</sup>

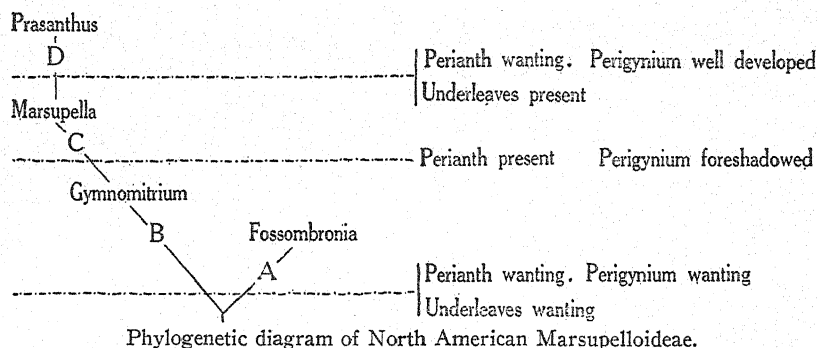
Plants in patches or mats, rarely the patches becoming dense cushions, grayish or brownish to blackish purple; leafy shoots 0.1-2 mm wide, often clavate. Stems prostrate to erect, usually 0.5-2 cm long, but in a few vigorous species up to 10 cm, simple to abundantly branched chiefly from the base or from beneath the perianth. Rhizoids not in tufts. Leaves alternate, transversely inserted with a tendency toward the succubous in some species, not decurrent, very closely appressed-imbricate to continuous or distant and spreading, simply and slightly 2-lobed, in some species their margins or tips or both quite markedly hyaline and thus causing the gray color of the plant. Gemmae wanting. Underleaves wanting except in *Prasanthus*. Plants unisexual or bisexual; both inflorescences on normal leafy shoots. Female bracts larger than the leaves, 2-lobed, with hyaline margins at least in many species; bracteole present only in *Prasanthus*. Perianth wanting to present, when present united with the bases of the female bracts. Perigynium wanting to cup-like. Sporangium spherical to ovoid, opening by valves, its wall 2 cells thick. Elaters with 2-4 spirals.

The cross section of the seta of *Gymnomitrium corallioides* is drawn by Douin (115.2) and shows many cells, all quite similar. K. Mueller (409) mentions that *Marsupella sphacelata* is reported to have the cells all similar in cross section of seta, while he states that the epidermal ones are distinctly larger in *M. sparsifolia*, *M. emarginata* and *M. sphacelata* var. *erythrorhiza*. The structure of the seta may prove to be one of the strongest factors in arranging species and varieties in *Marsupella* and *Gymnomitrium*. It cannot be used until more is known about it.

- Perianth wanting; perigynium wanting; most species gray, some brown; female bracts free; underleaves wanting . . . . . *Gymnomitrium*, p. 207.  
 Perianth present; perigynium wanting but foreshadowed by thick perianth with bracts somewhat united with it, parallel with the stem, without rhizoids; all species brownish to blackish; female bracts connate; underleaves wanting . . . . . *Marsupella*, p. 217.  
 Perianth wanting; perigynium cup-like, at right angles to the stem; densely rhizoidous; the species grayish; female bracts connate; underleaves present but small . . . . . *Prasanthus*, p. 233.

The absence of perianth seems to be a very low character when there is no perigynium. When there is a perigynium, the absence of perianth may be due to the crowding of parts at the mouth of the perigynium and thus no longer can be considered a low character. We consider *Gymnomitrium* a low genus.

<sup>85</sup> mār' sū pēl lōi' dē ē.



#### RELATIONSHIPS AMONG NORTH AMERICAN MARSUPELLOIDEAE

The statements under the letters below refer to the corresponding letters on the diagram above.

(A) Leaves succubous but nearly transverse; antheridia dorsal on the stem; archegonia dorsal on the stem close to the dorsal margins of the leaves. Sporangium dehiscing irregularly.

(B) Leaves transverse; antheridia in the axils of bracts; archegonia on the end of the stem; perianth wanting or represented by some small free bracts. Sporangium dehiscing by valves.

(C) Perigynium wanting but foreshadowed by a fleshy perianth which continues in the direction of the stem.

(D) Perigynium well developed and at right angles to the direction of the stem, densely rhizoidous.

#### GYMNOMITRIUM<sup>50</sup> Corda, Opiz, Beitr. 651, 1828.

*Cesius* S. F. Gray Nat. Arr. Brit. Pl. 1:705, 1821, in part. Not *Caesia* R. Br. 1810, a genus in the Liliaceae.

*Acolea* Dum. Syll. Jung. Eur. 76, 1831.

*Sarcoscyphus* Nees Naturg. Eur. Leberm. 2:414, 1836, in part.

*Nardia* Lindb. Musci Scand. 8, 1879, in part.

*Cesia* Lindb. Musci Scand. 9, 1879.

Plants small, densely pulvinate, often glaucescent or fuscous. Stems prostrate to erect, unbranched to much branched, often stoloniferous, growing by an apical cell which cuts from 3 sides. Leaves alternate, transversely inserted, not decurrent, in most species closely imbricate and gradually increasing in size toward the stem tips, simply somewhat 2-lobed, strongly concave, often more or less of the leaf hyaline. Gemmae wanting. Underleaves wanting. Plants unisexual or rarely bisexual; both inflorescences terminal or nearly so on a normal leafy shoot. Female leafy

<sup>50</sup> jīm nō mīt' rī ūm. Gymnomitrium by Corda. The question of priority between *Cesia* and *Gymnomitrium* seems to rest upon the question whether *Cesius* of Gray, outside of its gender, is merely a variant of *Caesia* of R. Br.



shoots clavate in most species; female bracts much larger than the leaves of sterile shoots, much wider, 2-lobed, hyaline. Perianth wanting or represented sometimes by a few small separate bracts. Calyptra free, usually with some sterile archegonia on the upper part of its surface. Sporangium spherical or ovoid, opening by valves; wall of 2 layers of cells. Elaters with 2 or rarely more spirals. Name from Gk. *gymnos*, naked, and *mitrion*, a little cap; referring to the absence of perianth around the calyptra.

The subgenera *Eugymnomitrium* and *Homocraspis* are recognized by many workers but are based upon vegetative characters; we doubt whether the groups express any particular relationship of one species to another. It will be observed that the distinctions between species also are based almost entirely upon vegetative characters. The sporophytes of the species are in urgent need of detailed study. Apparently the basic specific distinction should rest upon the form of the thickenings in the cells of the inner wall of the sporangium. They are, however, insufficiently observed. In those species in which semiannular thickenings are reported as sometimes present and sometimes not, it may be that sometimes a mature sporangium was examined and sometimes a younger one. Thickenings of the cell walls are likely to be more reliable in determining relationships than proximity, form, size and color of leaves. Cross sections of stems and of setae might be enlightening.

- |   |                             |
|---|-----------------------------|
| A. Plants green, or yellowish brown in <i>G. concinnatum</i> ; leaves with whitish margin and tip except sometimes in <i>G. concinnatum</i> , margin not revolute.  |                             |
| B. Leafy branches distinctly flattish from the closely appressed leaves; leaf sinus extending $\frac{1}{8}$ - $\frac{1}{10}$ down or else lost through erosion.   | 2. <i>G. corallioides</i> . |
| BB. Leafy branches not or hardly flattish; leaf sinus extending $\frac{1}{6}$ - $\frac{1}{3}$ down.   |                             |
| C. Marginal leaf cells elongated diagonally, projecting variously and some of them as much as the width of the projecting cell; hyaline margin almost limited to the marginal row; antheridia 1 in each bract axil. | 3. <i>G. crenulatum</i> .   |
| CC. Marginal leaf cells sometimes elongate but at most the cells projecting as low crenulations; antheridia 2 in each bract axil.   |                             |
| D. Leaf lobes acute; sinus acute and open; margins entire or barely crenulate; trigones often bulging into the cells.   | 5. <i>G. concinnatum</i> .  |
| DD. Leaf lobes roundish; sinus acute but closed; margins with low crenulations; trigones not bulging into the cells.  | 4. <i>G. obtusum</i> .      |
| AA. Plants reddish brown or black, without whitish border.  |                             |
| E. Margin of leaf not revolute; leaves 350-500 $\mu$ long; inner layer of wall of sporangium with nodular thickenings; cuticle smooth; elaters with 3-4 spirals.  | 1. <i>G. varians</i> .      |
| EE. Margin of leaf revolute all around; leaves 600-800 $\mu$ long; inner layer of wall of sporangium with semiannular thickenings; cuticle verruculose; elaters with 2 spirals.                                     | 6. <i>G. revolutum</i> .    |

1. *Gymnomitrium varians*<sup>87</sup> (Lindb.) Schiffn., Engler & Prantl Nat. Pfl.-Fam. 1(3):77, 1893.

*Nardia varians* Lindb. Musci Scand. 9, 1879.

*G. crassifolium* Carr., Trans. Bot. Soc. Edinburgh 13:461, 1879.

*Sarcoscyphus confertus* Limpr., Jahresh. Schles. Ges. Vaterl. Kult. 57:312, 1880.

*G. confertum* Limpr., Flora 64:73, 1881.

*Marsupella conferta* Spruce, Revue Bryol. 8:95, 1881.

*G. ambiguum* Massal. & Cares., Nuovo Giorn. Bot. Ital. 14:218, 1882.

*Caesia varians* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

*Caesia crassifolia* Lindb. Medd. Soc. Fauna Fl. Fennica 14:48, 1888.

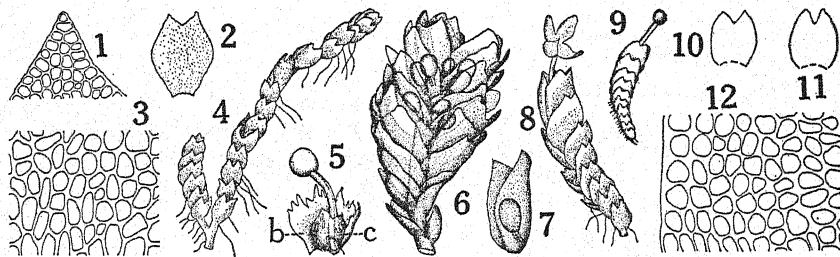
*Acolea varians* Steph., Bull. Herb. Boissier, Ser. 2, 1:149, 1901; also Sp. Hep. 2:10, 1901.

*Acolea crassifolia* Steph., Bull. Herb. Boissier, Ser. 2, 1:150, 1901; also Sp. Hep. 2:11, 1901.

*Cesia conferta* Pears. Hep. Brit. Isles 1:397, 1902.

*Acolea conferta* Lett. List Spec. Hep. Brit. Isles 181, 1902.

Plants in dense mats or scattered among mosses, reddish brown to nearly black; leafy shoots subterete, 400-500  $\mu$  thick or near the tip up to 750  $\mu$ . Stems 4-10 mm long, irregularly branched, frequently innovating; branches erect or suberect. Rhizoids few except at base of stem. Leaves gradually slightly larger up the stem, especially so on fertile ones, rather densely imbricate on the fertile stems, erect-spreading, simply 2-lobed, concave, broadly oval, 350-500  $\mu$  long, about 250  $\mu$  wide; lobes



*Gymnomitrium varians*. 1, Tip of leaf, x141. 2, Leaf, x17.6. 3, Cells of the leaf middle, x192. 4, Part of a plant, x8.8. 5, Female bract (*b*), calyptra (*c*) and sporophyte, x22. 6, Upper part of male stem, with antheridia, x22. 7, Male bract with an antheridium, x22. 8, Tip of female stem with sporophyte, x8.8. 9, Plant with sporophyte, x8.5. 10-11, Leaves, x35. 12, Cells of the leaf margin, x192. (1-2, 4, 8, after K. Mueller; 3, 12, original, by Elizabeth Curtis; 5-7, after Pearson; 9-11, after Meylan.)

triangular-ovate, subacute, slightly incurved; sinus descending  $\frac{1}{5}$ - $\frac{1}{3}$  the leaf length, acute or subacute to somewhat right-angular. Cells of the leaf middle 14-18  $\mu$ , of the margin 9-10  $\mu$ ; walls thick; trigones rather large, concave; oil bodies usually wanting; cuticle smooth. Plants bisexual or unisexual. Male inflorescence sometimes below the female, sometimes on separate branches or on separate plants; male bracts several pairs, subrotund, often with an obtuse lobe-like tooth on the dorsal margin; anther-

<sup>87</sup> vā' rī āns.

idia 1-2, ovoid, stalked; the stalk about as long as the body, 2 cells thick. Female leafy branches not markedly clavate; female inflorescence inconspicuous; female bracts much wider and more concave than the leaves, less deeply lobed than the leaves, their lobes apiculate, oblong. Seta about 1.5 mm long; in cross section 7-9 cells thick, with 25-28 epidermal cells. Sporangium ovoid-globose, about  $335\ \mu$  thick, dark brown, opening by valves; wall 2 cells thick; both layers of wall cells with nodular thickenings, without semiannular thickenings. Elaters 70-120  $\mu$  long, 8-10  $\mu$  wide, often branched; spirals 3-4. Spores 8-12  $\mu$ , finely granulate, pale, reddish brown. So named from the variability in the location of the male inflorescence with relation to the female.—On bare moist soil at high altitudes.

ILLUSTRATIONS: Carrington, Trans. Bot. Soc. Edinburgh 13: pl. 18, fig. 3, 1879; Pearson (433) 2: pls. 174-175; K. Mueller (409) 1: fig. 237; Macvicar (374) 103, figs. 1-3; Meylan (386) fig. 60.

EXAMINATIONS: B. C. Simpson Pass, W. Banff (Brinkman 973) 1913,<sup>38</sup>—Wash. Mt. Baker (Grant) 1929.

TYPE LOCALITY: Scandinavian Peninsula.

RANGE: Alta. (194), B. C. (96), Wash. (99); Eur. (329).

2. *Gymnomitrium corallioides*<sup>39</sup> Nees Naturg. Eur. Leberm. 1:118, 1833.

*Acolea corallioides*<sup>40</sup> Dum. Rec. d'Obs. 23, 1835.

*Cesia corallioides* Carruth., Jour. Bot. 3:300, 1865.

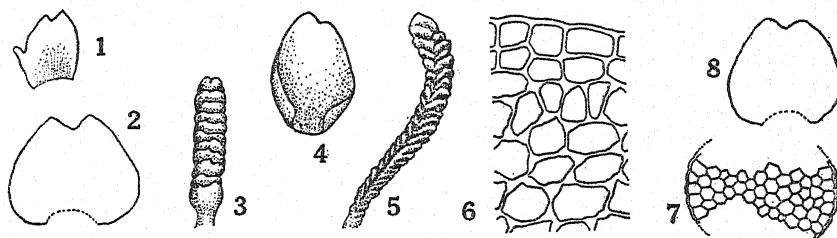
Plants in dense patches, whitish or grayish with a tinge of dark gray or black; leafy shoots about 500  $\mu$  wide. Stems 1-4 cm long, fragile, much branched; sterile leafy branches simple, arcuate, much compressed, somewhat lanceolate. Rhizoids numerous even far up the stem. Leaves transversely inserted, very densely compressed-imbricate so as to be hardly visible, symmetrically appressed, very shallowly 2-lobed especially when young, broadly oval, very concave, 600-700  $\mu$  long, almost the whole leaf hyaline and somewhat transparent; apex often rounded in old leaves; margin plane, soon becoming erose; lobes at first subacute with a projecting acute apical cell, quite soon becoming obtuse to rounded through the breaking down of the cells at the apex; sinus acute. Cells of the leaf middle 15-26  $\mu$ , oblong or oval, with walls thinner than in the submarginal row, with large and often confluent trigones; cells of the marginal row larger than those of the second row, diagonally 1.5-2 times as long as wide, with thin walls; the second row rounded to slightly elliptic, with thick walls; basal cells larger than median ones, thin walled, with small

<sup>38</sup> A. W. Evans in Bryologist 25:26, 1922, mentions this material as "collected at and near Simpson Pass, vicinity of Banff, British Columbia." However, as Banff is 10 miles or so from the British Columbia boundary in Alberta, it is questionable which province should be given as a reference.

<sup>39</sup> *kör' äi li öi' dës.*

<sup>40</sup> Dumortier, Hep. Eur. 122, 1874, spells it *coralloides*. This is most likely merely an error.

but sometimes distinct trigones; cuticle quite smooth. Plants unisexual. Male bracts several pairs, similar to the leaves but less closely imbricate, squarrose at tip, with a tooth on the dorsal margin; antheridia 2. Female leafy branches clavate; female inflorescence ovoid, on very short and slightly compressed branches; female bracts with the margin usually slightly reflexed, distinctly and irregularly lobed and dentate; the lobes



*Gymnomitrium corallioides*. 1, Male bract with tooth on dorsal margin, x 12.7. 2, Female bract, x 29. 3, Part of shoot, side view, x 15.9. 4, Leaf not spread out, x 29. 5, Part of leafy shoot, dorsal view, x 6.6. 6, Cells along margin of leaf, x 370. 7, Cross section of seta, x 53. 8, Leaf, spread out, x 29. (1, after Pearson; 2-4, 8, after Meylan; 5, after K. Mueller; 6, original by Elizabeth Curtis; 7, after Douin.)

acute, with projecting terminal cells. Seta very short, about 13 cells thick; in cross section the cells all very similar, walls thin except the cuticular one. Sporangium spherical, reddish brown; valves broadly ovate, sometimes not separated to base, acute, with hyaline margin; walls of 2 layers of cells, both with nodular thickenings. Elaters 100  $\mu$  long, 8  $\mu$  wide; spirals 2. Spores 12-16  $\mu$ , minutely verruculose, reddish brown. So named on account of the commonly whitish coral-like appearance.— On rocks in alpine regions.

ILLUSTRATIONS: Pearson (433) 2: pl. 177; K. Mueller (409) 1: fig. 232; Macvicar (374) 100, figs. 1-3; Meylan (386) fig. 57; Douin, Bull. Soc. Bot. France 55: pl. 8, fig. 33, 1908.

EXAMINATIONS: *Alaska*. St. Paul Island (Kincaid 235) 1897.—*N. H.* Mt. Adams in Coos County (Evans) 1917; Mt. Monroe in Coos County (Evans) 1917; Mt. Washington (Evans) 1927.

TYPE LOCALITY: Riesengebirge in Germany.

RANGE: Greenland (322), Ellesmere Isl. (56.01), Me. (185), N. H. (140), N. Y. (5), Que. (178), Yukon (298), Alaska (135); Asia (350); Eur. (374); Spitzbergen (409); Jan Mayen Isl. (320.4).

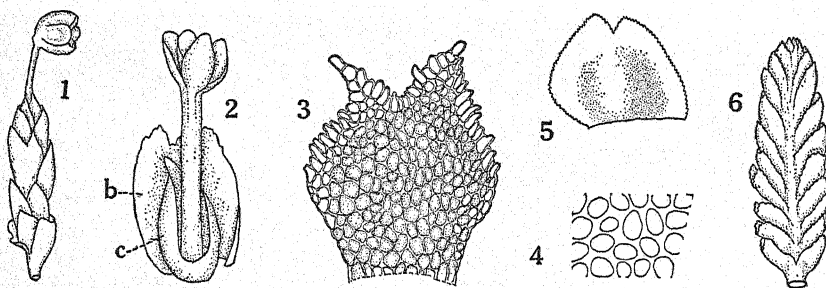


3. *Gymnomitrium crenulatum*<sup>41</sup> Gottsche in Carr., Trans. Bot. Soc. Edinburgh 7:18, 1863.

*Cesia crenulata* Carruth., Jour. Bot. 3:300, 1865.

*Acolea crenulata* Dum. Hep. Eur. 123, 1874.

Plants in small dense intricate patches, reddish coppery brown, or sometimes olive green especially in shade; leafy shoots somewhat terete, about  $300\ \mu$  thick. Stems up to 1 cm long, filiform, wiry, much branched; sterile leafy branches long, flexuose, arcuate, slightly compressed, of nearly the same diameter throughout, their apices subacute. Rhizoids on the stolons. Leaves transversely inserted, very densely imbricate and thus hardly visible without magnification, symmetrically appressed, simply 2-lobed, broadly ovate,  $280\text{--}320\ \mu$  long, very concave; margin markedly crenulate all around with projecting cells, narrowly hyaline; lobes tri-



*Gymnomitrium crenulatum*. 1, Tip of shoot with sporophyte,  $\times 42$ . 2, Female bract (b), calyptra (c) and sporophyte,  $\times$  about 85. 3, Leaf,  $\times 106$ . 4, Leaf cells,  $\times 154$ . 5, Male bract,  $\times 45$ . 6, Tip of sterile shoot,  $\times 49$ . (3, after K. Mueller; the others after Pearson.)

angular, acute, connivent; sinus descending  $\frac{1}{5}\text{--}\frac{1}{4}$  the leaf length, acute. Cells of the leaf middle and including the submarginal row  $16\text{--}21\ \mu$ , rounded-oblong; cells of the marginal row in the upper  $\frac{1}{2}\text{--}\frac{4}{5}$  of the leaf diagonally 2-3 times as long as wide, narrowed outward; walls somewhat thickened; trigones rather small; cuticle nearly smooth. Plants unisexual; both inflorescences terminal on normal leafy shoots. Male bracts wider and more concave than the leaves, otherwise similar; antheridium usually 1, ovoid-globose, with short stalk. Female leafy branches clavate, female inflorescence ovoid, on a short branch; female bracts strongly involute; lobes crenulate, acute with prominent terminal cell; innermost bracts very delicate, oblong. Seta slightly projecting beyond the leaves. Sporangium spherical, reddish brown, opening by valves. Spores  $14\text{--}16\ \mu$ , minutely verruculose. Name from the markedly crenulate leaves.—On rocks in subalpine regions.

<sup>41</sup> krên ù lă' tùm.



ILLUSTRATIONS: Macvicar (374) 101, figs. 1-3; Pearson (433) 2: pl. 180; K. Mueller (409) 1: fig. 235.

EXAMINATIONS: None.

TYPE LOCALITY: British Isles.

RANGE: Alaska (173); Eur. (374); South Georgia Isls. (409); Antarctic regions (409).

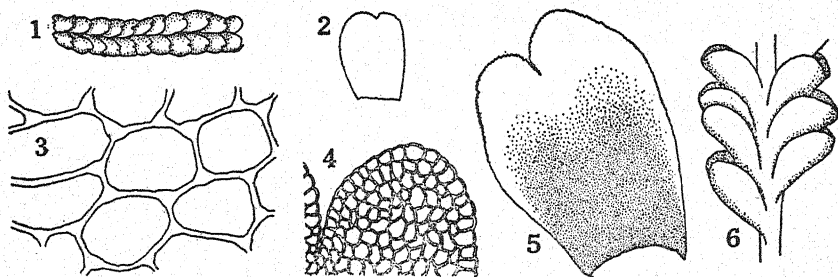
4. *Gymnomitrium obtusum*<sup>42</sup> (Lindb.) Pears., London Jour. Bot. 18:337, 1880.

*Cesia obtusa* Lindb. Musci Scand. 9, 1879.

*G. concinnatum* var. *obtusum* Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 58:186, 1881.

*Acolea obtusa* Bernet Cat. Hep. Suisse 24, 1888.

Plants in dense mats or among mosses, whitish or pale green, sometimes somewhat reddish brown toward tip; leafy shoots 200-300  $\mu$  thick. Stems up to 2 cm long, simple or sparingly branched; sterile leafy branches terete, of nearly the same diameter throughout, canaliculate on the dorsal side when dry. Leaves transversely inserted, densely imbricate,



*Gymnomitrium obtusum*. 1, Tip of sterile shoot, dorsal view,  $\times 34$ . 2, Leaf,  $\times 164$ . 3, Cells of the leaf middle,  $\times 480$ . 4, Lobe of a leaf,  $\times 132$ . 5, Leaf, the unshaded part hyaline,  $\times 66$ . 6, Dorsal view of part of sterile shoot,  $\times 21$ . (1-2, after Pearson; 4, after K. Mueller; the others original.)

symmetrically appressed, simply 2-lobed, broadly ovate or oval, 600-900  $\mu$  long, very concave; margin reflexed on dorsal side of plant, almost the whole margin and the upper half of the leaf broadly hyaline, entire at base but above it somewhat crenulate by bulging cells; lobes roundish at tip; sinus descending  $\frac{1}{6}$ - $\frac{1}{4}$  the leaf length, very acute, closed. Cells of the leaf middle 15-30  $\mu$ , of the margin 12-14  $\mu$ ; walls thin; trigones rather small to somewhat bulging; cuticle minutely verruculose. Plants unisexual; both kinds of sexual leafy shoots club-shaped, slightly flattish; both inflorescences terminal on main stems. Male bracts several pairs, imbricate, similar to the leaves, the dorsal margin reflexed; antheridia 2. Female inflorescence ovate; female bracts involute, irregularly and shal-

<sup>42</sup> ob tū' sūm.

lowly lobed; their lobes subacute, crenulate; archegonia numerous, 12 or fewer. Sporangia but slightly exserted, spherical, dark brown, opening by valves; wall 2 cells thick. Elaters 40-70  $\mu$  long, about 7  $\mu$  wide; spirals 2, brown. Spores 12-14  $\mu$ , minutely verruculose, brown. Name from the blunt tips of the lobes of the leaves.—On rocks or rarely on soil; in rather high altitudes.

ILLUSTRATIONS: Pearson (433) 2: pl. 179; Evans, Proc. Wash. Acad. Sci. 2: pl. 16, figs. 1-3, 1900; K. Mueller (409) 1: fig. 234; Macvicar (374) 99, figs. 1-3; Meylan (386) fig. 59.

EXAMINATIONS: *Alaska*. Brownson Bay (Frye) 1913; Nichols Bay (Frye) 1913.—*Wash.* Darrington (Frye) 1928; Snow Lake trail from Snoqualmie Pass (Bailey) date uncertain; Mt. Constitution on Orcas Island (Wolfe) 1930.

TYPE LOCALITY: European.

RANGE: Greenland (135), Alaska (173), B. C. (372), Mont. (328), Wash. (81), Ore. (82); Eur. (409); Caucasus Mts. (409).

5. *Gymnomitrium concinnatum*<sup>43</sup> (Lightf.) Corda in Sturm, Deutschl. Fl., Abt. 3, 19:23, 1829.

*Jungermannia concinnata* Lightf. Fl. Scot. 2:786, 1777.

*Cesius concinnatus* S. F. Gray Nat. Arr. Brit. Pl. 1:705, 1821.

*Schisma concinnata* Dum. Comm. Bot. 114, 1822.

*Acolea concinnata* Dum. Syll. Jung. Eur. 76, 1831.

? *Jungermannia gymnomitrioides*<sup>44</sup> Nees Naturg. Eur. Leberm. 2:52, 1836.

*Cesia concinnata* Lindb. Musci Scand. 10, 1879.

*G. concinnatum* var. *intermedia*<sup>45</sup> Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 58:186, 1881.

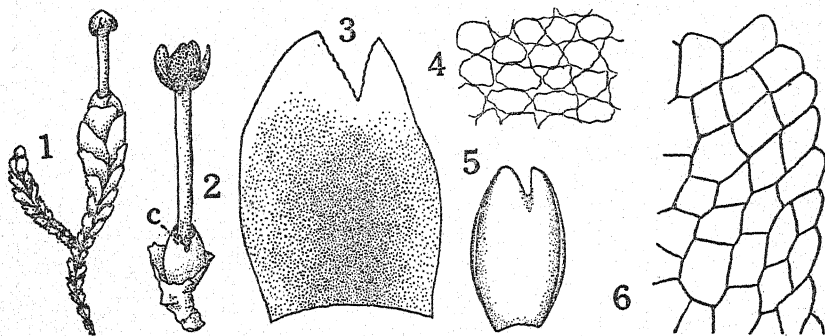
Plants in dense patches, brownish yellow to greenish white or occasionally silvery in color; sterile leafy branches terete, 400-600  $\mu$  thick, nearly the same diameter throughout or thicker toward the extremity. Stems 0.5-3 cm long, simple or sparingly branched. Leaves transversely inserted, densely imbricate, slightly secund dorsally, simply 2-lobed, broadly oval, very concave, about 1 mm long; margin not or only indistinctly hyaline, reflexed on dorsal side of plant; margins entire to slightly irregularly crenulate by bulging cells; lobes broadly triangular, acute or occasionally somewhat obtuse; sinus descending  $\frac{1}{5}$ - $\frac{1}{3}$  the leaf length, wide, acute. Cells of leaf middle 16-21  $\mu$ , with moderately thick walls, with large trigones; those of the margin about 8  $\mu$ , roundish-quadrate to quadrate, with greatly and nearly equally thickened walls; of the base larger, with thin walls and small trigones; oil bodies 2-5, spherical; cuticle minutely verruculose. Plants unisexual; both inflorescences ter-

<sup>43</sup> kōn sīn nā' tūm.

<sup>44</sup> There is doubt as to just what Nees had before him. His material was gathered in the Tyrol region of the Alps.

<sup>45</sup> We do not consider this varietally distinct from the type. It has been reported from British Columbia (51).

minal, on similar clavate leafy shoots. Male bracts similar to the leaves but less closely imbricate, the dorsal margin reflexed; antheridia 2, ovoid, long-stalked. Female inflorescence ovoid; female bracts involute, irregularly lobed, dentate, laciniate. Seta 3.5 mm long. Sporangium spherical,



*Gymnomitrium concinnatum*. 1, Female plant, dorsal view,  $\times$  about 11. 2, Sporophyte with calyptra (*c*),  $\times$  about 21. 3, Leaf, the unshaded portion hyaline,  $\times$  40. 4, Cells of the leaf middle,  $\times$  197. 5, Leaf,  $\times$  about 23. 6, Cells of leaf margin from tip downward,  $\times$  321. (3, original by Helen M. Gilkey; 6, original by Elizabeth Curtis; 4, after K. Mueller; 1-2, 5, after Hooker.)

dark brown, its wall of 2 layers of cells; both layers with nodular thickenings, the inner with rudimentary or no spiral thickenings. Elaters 120  $\mu$  long, 8  $\mu$  wide, equally narrowed toward the two ends; spirals 2, closely wound. Spores 12-15  $\mu$ , minutely verruculose, reddish brown. Name from *L. concinnus*, well put together, from the compacted leafy shoots.—On rocks which are thinly covered with dirt; on bases of trees.

ILLUSTRATIONS: Hooker (285) pl. 3; Ekart (124) pl. 8, fig. 63; Pearson (433) 2: pl. 178; K. Mueller (409) 1: figs. 231, 233; Macvicar (374) 97, figs. 1-3; Meylan (386) fig. 58; Gil (76) fig. 198; Jensen (323.5) 79, 3 figs.

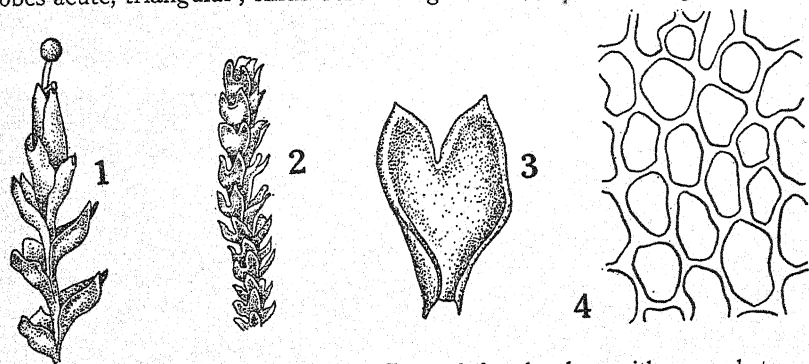
EXAMINATIONS: *Mont.* Columbia Falls (Williams) 1895.—*N. H.* Mt. Washington in Coos County (Lorenz 113) 1906; Mt. Adams in Coos County (Evans) 1917; Mt. Monroe in Coos County (Evans) 1917.—*Wash.* Queets River Valley, Olympic Mts. (Frye 800) 1907; Mt. Baker (Grant 8533) 1929.

TYPE LOCALITY: Scotland.

RANGE: Greenland (322), Labrador (373), Me. (333), N. H. (359), Que. (178), Mont., Alta. (51), Alaska (135), B. C. (373), Wash. (81); S. Amer. (458); Antarctic regions (458); Asia (458); Eur. (374); Spitzbergen (248.1); Jan Mayen Isl. (320.4); Iceland (248.1).

6. *Gymnomitrium revolutum*<sup>46</sup> (Nees) Philibert, Revue Bryol. 17:34, 1890.*Sarcoscyphus revolutus* Nees Naturg. Eur. Leberm. 2:419, 1836.*Nardia revoluta* Lindb., Acta Soc. Sci. Fennica 10:113, 1871.*Marsupella revoluta* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.*Cesia revoluta* Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):65, 1889.

Plants in dense patches, small, black or brownish black; leafy shoots flattened, 1-2 mm wide. Stems erect, simple or dichotomously branched, leafless below; stolons with minute leaves. Rhizoids few. Leaves alternate, close together or subimbricate, gradually larger up the stem, spreading, simply 2-lobed, oval to obovate or spatulate, semi-clasping at the narrow base, firm, concave, up to 700  $\mu$  long; margin revolute all round; lobes acute, triangular; sinus descending about  $\frac{1}{3}$  the leaf length, acute to



*Gymnomitrium revolutum*. 1, Part of female plant with sporophyte,  $\times 106$ . 2, Part of sterile plant,  $\times 7$ . 3, Leaf,  $\times 35$ . 4, Cells of the leaf middle,  $\times 580$ . (4, original, from European material, by Elizabeth Curtis; the others after K. Mueller.)

obtuse. Cells of leaf middle 12-18  $\mu$ , subquadrate to oblong-quadrate; walls rather thin; trigones none or small; cuticle verruculose. Plants unisexual; both inflorescences terminal on normal leafy shoots. Antheridia 1-2. Female bracts larger than the leaves, irregularly lobed to subentire, ovate, pale, delicate; their margins plane; their lobes obtuse; the sinus descending  $\frac{1}{5}$ - $\frac{1}{4}$  the length of the bract, obtuse. Calyptra large. Seta exserting the sporangium. Sporangium spherical, about 500  $\mu$  thick, brown, opening by valves, its wall 2 cells thick; epidermis with nodular thickenings; cells of inner wall layer with semiannular thickenings. Elaters about 100  $\mu$  long and 6  $\mu$  wide; spirals 2, yellowish brown. Spores about 12  $\mu$ , spherical to angular, yellowish brown. Name from *L. re*, back, and *volvo*, roll; in reference to the revolute margin of the leaf.—On rocks.

ILLUSTRATIONS: Pearson (433) 2: pl. 173; K. Mueller (409) 1: fig. 239; Meylan (386) fig. 62.

EXAMINATIONS: None.

TYPE LOCALITY: Tyrolean Alps (Funck).

RANGE: Greenland (322); Eur. (409); Asia (247.08).

<sup>46</sup> r'ev' o' l'ũ' tũm.



MARSUPELLA<sup>47</sup> Dum. Comm. Bot. 114, 1822.*Nardius* S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821, in part.*Sarcoscyphos* Corda, Opiz, Beitr. 652, 1828.*Marsupia* Dum. Syll. Jung. Eur. 77, 1831.*Sarcoscyphus* Nees Naturg. Eur. Leberm. 1:122, 1833. Not of Fries Syst. Mycol. 2:78, 1823.*Nardia* Carr., Trans. Bot. Soc. Edinburgh 10:309, 1870, in part.

Plants forming mats or patches, green to purplish red or black. Stems up to 10 cm long, prostrate to erect, simple to abundantly branched, stoloniferous toward base. Leaves alternate, transversely inserted or slightly succubous, not or hardly decurrent, closely appressed to spreading, more or less concave, simply 2-lobed; the lobes about equal; margin entire to sinuate, sometimes crenulate by projecting cells, sometimes more than 1 cell thick. Gemmae wanting. Underleaves wanting. Plants unisexual or bisexual. Antheridia terminal, or in the axils of bracts just below the tip, or farther down the stem. Female inflorescence terminal on normal leafy shoots; female bracts erect, larger than the leaves, connate at base; bracteole wanting. Perianth immersed, the basal part united with the bracts, broadly obconic to ovoid, the free tip conic; mouth 4-6-lobed when mature. Calyptra with sterile archegonia about its base. Sporangium spherical, usually 4-valved to near its base; wall of 2 layers of cells, both layers with nodular thickenings on the walls, the inner layer with or without semi-annular thickenings. Elaters with 2-4 spirals. Name the diminutive of *L. marsupium*, a money-bag, from the resemblance to the constricted mouth of the perianth.

The species of *Marsupella* are urgently in need of comparative study. When the facts are observed, there probably will be at least four basic criteria upon which relationships within the genus will be based: (a) the thickenings in the wall cells of the sporangia, (b) the cross section of the seta, (c) the unisexual or bisexual inheritance, (d) the degree of differentiation of cortex in the stem. Of these, details of the first two and the last are as yet largely unobserved.

- |   |                           |
|---|---------------------------|
| A. Leaves about as closely imbricated and applied to each other to their very tips as it is possible for them to be, bordered with hyaline cells.....   | 1. <i>M. apiculata</i> .  |
| AA. Leaves from quite imbricate to merely contiguous or distant, but never closely applied to each other, without hyaline border except sometimes in <i>M. emarginata</i> var. <i>arctica</i> . |                           |
| B. Leaf sinuses rounded or crescentic; leaf lobes acute.....  | 2. <i>M. condensata</i> . |
| BB. Either the leaf sinuses obtuse to acute, or the leaf lobes obtuse to rounded.   |                           |
| C. Most of the leaf sinuses acute to right-angular, $\frac{1}{4}$ - $\frac{1}{2}$ the leaf length deep; lobes of the leaves various.  |                           |
| D. Leaves about 1.5 times as long as wide; sinus descending almost half the leaf length; both sinus and lobes acute.....  | 3. <i>M. boeckii</i> .    |

<sup>47</sup> mār sū pēl' lā.

- DD. Leaves from wider than long to slightly longer than wide; sinus descending  $\frac{1}{4}$ – $\frac{1}{2}$  the leaf length; rarely both sinus and lobes acute.
- E. Leaves mostly widest above their middle; trigones large, commonly bulging into the cells..... 5a. var. *erythrorhiza*.
- EE. Leaves widest at or below their middle; trigones various.
- F. Trigones small.
- G. Stems 2.5–4 cm long; rhizoids few; leaf lobes rounded; cells of the leaf middle 21–28  $\mu$ , the marginal ones 10–12  $\mu$ ; plants unisexual..... 5. *M. sphacelata*.
- GG. Stems 0.6 cm or less long; rhizoids numerous; leaf lobes obtuse; cells of the leaf middle 18–36  $\mu$ , the marginal ones 16–25  $\mu$ ; plants unisexual..... 4. *M. bolanderi*.
- GGG. Stems 0.6 cm or less long; rhizoids numerous; leaf lobes acute to obtuse; cells of the leaf middle 12–18  $\mu$ , the marginal ones 8–10  $\mu$ ; plants bisexual..... 7. *M. ustulata*.
- FF. Trigones large, commonly bulging into the cells; plants bisexual..... 6. *M. sparsifolia*.
- CC. Most of the leaf sinuses rounded to crescentic, nearly obsolete to  $\frac{1}{4}$  the leaf length deep; lobes of the leaves obtuse to roundish.
- H. Leaf sinus descending  $\frac{1}{6}$ – $\frac{1}{4}$  the leaf length, V-shaped to broadly crescentic..... 8. *M. emarginata*.
- HH. Leaf sinus from obsolete to  $\frac{1}{10}$  the leaf length, rounded to crescentic.
- I. Leaf margin revolute dorsally; leaves widest above their middle; sterile leafy shoots 1–2 mm wide... 8a. var. *pearsonii*.
- II. Leaf margin slightly revolute toward the base; leaves widest about their middle; sterile leafy shoots 2–3 mm wide..... 8b. var. *aquatica*.
- III. Leaf margin slightly involute; leaves widest about their middle; sterile leafy shoots 0.5–1 mm wide..... 8c. var. *arctica*.

1. *Marsupella apiculata*<sup>48</sup> Schiffn., Oesterr. Bot. Zeitsch. 53:23, 1903.

*Gymnomitrium condensatum* Breidl., Mitt. Naturw. Ver. Steiermark 30:281, 1893.

Not of Angstr., in Hartm. Skand. Fl., Ed. 10, 2:128, 1871.

*Cesia condensata* Lindb. Musci Scand. 9, 1879.

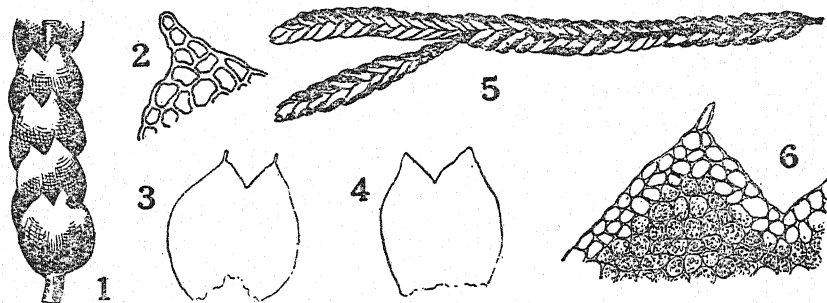
*M. condensata* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886. Not of Kaal., Vid. Skrift. I. Math. Nat. Klasse 1(9):22, 1898.

*Nardiocalyx apiculata* Joerg., Bergens Mus. Skrift. 16:74, 1934.

Plants in dense mats, brownish green or often with a reddish tinge; leafy shoots compressed, band-like, 330–750  $\mu$  wide. Stems 1–1.5 cm long, densely leafy, filiform, erect, simple or slightly branched, with erect innovations, with stolons. Rhizoids few, from near base of stem. Leaves imbricate, appressed, simply 2-lobed, cordate-subquadrate, nearly the same size up and down the stem, widest at base, very concave; lobes broadly triangular, acute, apiculate, the apex composed of 1–2 small hyaline cells; sinus wide, acute to right-angular, descending about  $\frac{1}{5}$  the leaf length; margin entire, hyaline for 1–2 cells wide. Cells of the leaf middle 16–25  $\mu$ ,

<sup>48</sup> ä pilk' ü lät' ä.

of the apical region 12-24  $\mu$ , round-hexagonal, the marginal 1-2 rows quadrate and with thick walls; trigones small to medium but distinct; cuticle smooth. Plants unisexual; both inflorescences terminal on normal leafy shoots. Male plants like the sterile ones but somewhat thicker and subclavate; male bracts several pairs, rather larger than the leaves; antheridia 2-3, rather long stalked. Female branch club-shaped; female



*Marsupella apiculata*. 1, Part of plant, side view,  $\times 14.5$ . 2, Tip of leaf,  $\times 254$ . 3, Leaf with the usual apiculate tips,  $\times 29$ . 4, Leaf without apiculate tips,  $\times 29$ . 5, Part of plant, dorsal view,  $\times 8.8$ . 6, Leaf lobe,  $\times 116$ . (2, after Macvicar; the others after K. Mueller.)

bracts much larger than the leaves; their margins hyaline for a greater width than in the leaves, toward base irregularly crenulate to denticulate by projecting cells. Perianth united with the bracts for about  $\frac{1}{3}$  its length, immersed, slightly plicate, conical above; mouth contracted, denticulate. Sporangium reddish brown; wall of 2 layers of cells, both layers without semiannular thickenings. Elaters about 7  $\mu$  thick; spirals 2, reddish brown. Spores about 10  $\mu$ , smooth, reddish brown. Name from *L. apiculus*, a little point; referring to the common occurrence of an elongate projecting cell at the tip of each lobe of the leaf.—On bare moist soil near the snow line.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 244; Macvicar (374) 107, figs. 1-3; Meylan (386) fig. 64.

EXAMINATIONS: None.

TYPE LOCALITY: Scandinavian Peninsula.

RANGE: Greenland (322); Eur. (409); Asia (325).

*Marsupella apiculata* was placed under *Gymnomitrium* so long as the closely appressed leaves of *Gymnomitrium* was considered the chief character of the genus. When it was recognized that the absence of perianth was the important character taxonomically, *Marsupella apiculata* was transferred to the genus *Marsupella* under the section *Nardiocalyx*. Joergensen (325) raised the section to generic rank, calling the plant *Nardiocalyx apiculata*. In general appearance it is very like *Gymnomitrium*, but the possession of a perianth allies it with *Marsupella*. Since the elevation of *Nardiocalyx* to a genus adds nothing to clarity, and is based upon vegetative differences only, we are not following Joergensen in this.

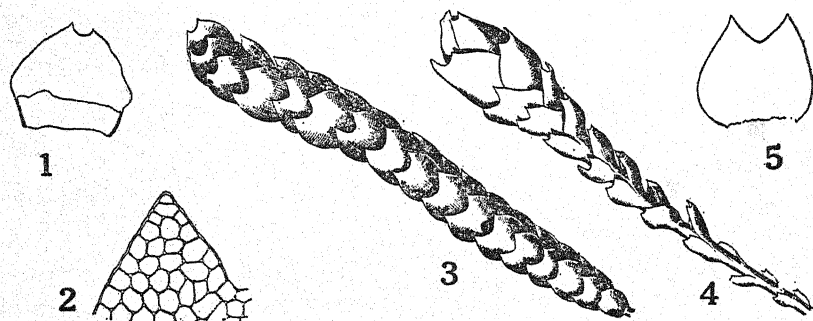


2. *Marsupella condensata*<sup>49</sup> (Angstr.) Kaal., Vid. Skrift. I. Math. Nat. Klasse 1(9):22, 1898. Not of Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

*Gymnomitrium condensatum* Angstr., in Hartm., Skand. Fl., Ed. 10, 2:128, 1871.  
Not of Breidl., Mitt. Naturw. Ver. Steiermark 30:281, 1893.

*Sarcoscyphus aemulus* Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 58:183, 1881.  
*M. aemula* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

Plants in dense mats, reddish brown to black; leafy branches terete, 250-410  $\mu$  thick. Stems 0.5-3 cm long, filiform, with several erect branches and long innovations, with many stolons, pale brown. Rhizoids numerous on the older parts, scarce on the young parts, colorless. Leaves transversely inserted, not decurrent, not very close but mostly overlapping somewhat, more erect than spreading, gradually larger upward on the stem, sometimes wanting on basal parts, slightly secund toward the dorsal side of the plant, simply 2-lobed, roundish-ovate, concave; lobes



*Marsupella condensata*. 1, Female bract with perianth in front of it cut off,  $\times 12$ . 2, Cells of a leaf lobe,  $\times 254$ . 3, Side view of sterile shoot,  $\times 19.8$ . 4, Shoot with female inflorescence,  $\times 11.9$ . 5, Leaf,  $\times 28$ . (All after K. Mueller.)

triangular, acute, often incurved, sometimes partly colorless; sinus descending  $\frac{1}{5}$ – $\frac{1}{4}$  the leaf length, crescentic; margin entire, not colorless. Cells of the leaf middle 16-18  $\mu$ , of the apical region 8-12  $\mu$ , round-hexagonal; walls considerably thickened; trigones from medium to rather large, distinct to more rarely indistinct; oil bodies spherical, 3-4 per cell; cuticle smooth. Plants unisexual; both inflorescences terminal on a normal leafy shoot. Male branches similar to the sterile ones; male bracts larger than the leaves, saccate at base, few; antheridia 3-4. Female inflorescence prominent, the leafy shoot club-like, large at tip as compared with a sterile shoot; female bracts broadly triangular to circular, much larger than the leaves, very concave, 2-lobed; lobes acute or apiculate; sinus usually lunate, descending about  $\frac{1}{6}$  the bract length; cells larger than in the leaves, 16-24  $\mu$ , with the distinct trigones. Perianth united with the

<sup>49</sup> kón dên sá' tã.



bracts for  $\frac{1}{4}$ – $\frac{1}{3}$  its length, conical, somewhat compressed dorsally, immersed in the bracts; mouth somewhat incurved, wide, somewhat irregularly crenulate-dentate. Sporangium yellowish brown. Elaters about 100  $\mu$  long, 7–7.5  $\mu$  thick; spirals 2, closely wound. Spores 10–12  $\mu$ , smooth, reddish brown. Name from the *L. condensus*, thickly crowded together; apparently referring to the rather closely applied and usually somewhat overlapping leaves.—On bare moist soil at or near the summer snow line.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 243; Macvicar (374) 109, figs. 1–3.

EXAMINATIONS: None.

TYPE LOCALITY: Laxfjaellet in Lulea, Lapland (Angstrom) 1864.

RANGE: Greenland (322); Spitzbergen (458); Eur. (409).

3. *Marsupella boeckii*<sup>50</sup> (Aust.) Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

*Sarcoscyphus boeckii* Aust., Bull. Torr. Bot. Club 3:9, 1872.

*Cephalozia divaricata* var. *latifolia* Lindb., Not. Saellsk. Fauna Fl. Fennica Foerh. 13:312, 1874.

*Nardia filiformis* Lindb. Musci Scand. 9, 1879.

*Nardia boeckii* Lindb. Musci Scand. 9, 1879.

*Jungermannia nevicensis* Carr., Trans. Bot. Soc. Edinburgh 13:464, 1879.

*Sarcoscyphus capillaris* Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 58:182, 1881.

*Hygrobiella nevicensis* Spruce, On Cephalozia 77, 1882.

*Nardia latifolia* Lindb., Medd. Soc. Fauna Fl. Fennica, Dec., 1882.

*M. filiformis* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

*M. latifolia* Lindb., Medd. Soc. Fauna Fl. Fennica 13:238, 1886.

*M. nevicensis* Kaal., Nyt. Mag. Naturvid. 33:417, 1893.

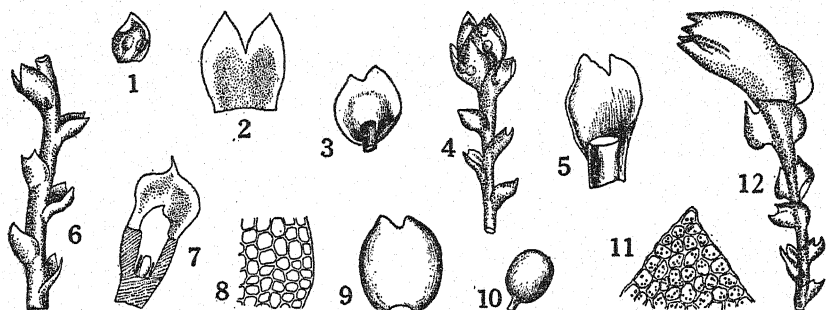
*M. lapponica* Loitl., Ann. K. K. Naturh. Hofmus Wein 13:192, 1898.

*M. boeckii* var. *nevicensis* Joerg., Bergens Mus. Skrift. 16:87, 1934.

*M. boeckii* var. *latifolia* Joerg., Bergens Mus. Skrift. 16:87, 1934.

Plants in patches, green to reddish; leafy shoots about 500  $\mu$  wide. Stems 1–2 cm long, suberect, with numerous flagella bearing very small leaves, green, filiform. Rhizoids almost wanting, colorless. Leaves transversely inserted, not decurrent, distant, mostly erect-spreading, simply 2-lobed, ovate-quadrate, 160–240  $\mu$  long; margin entire; lobes rather widely triangular, acute; sinus descending  $\frac{1}{4}$ – $\frac{1}{2}$  the leaf length, acute to obtuse; basal leaves squamiform, appressed, very distant. Cells of the leaf middle 12–16  $\mu$ , rounded-hexagonal; walls equally thickened or nearly so; trigones none or sometimes present in the basal angles; oil bodies numerous, small; cuticle smooth. Underleaves wanting. Plants unisexual. Male inflorescence terminal or lower down, prominent; male bracts few, much larger than the leaves, bulging on one edge, bilobed for about  $\frac{1}{3}$  their length; lobes acute; antheridia 1–3, usually 1. Female inflorescence terminal on a normal leafy shoot, ovoid, with 1–3 innovations; female bracts larger than the leaves, wider than long, broadly ovate,  $\frac{1}{4}$ – $\frac{1}{2}$ -bilobed when

<sup>50</sup> bék' i i.



*Marsupella boeckii*. 1, Male bract,  $\times 16.4$ . 2, Female bract,  $\times 12.7$ . 3, Leaf,  $\times 12.7$ . 4, Tip of shoot with male inflorescence and antheridia,  $\times 16.4$ . 5, Leaf,  $\times 34$ . 6, Part of a shoot,  $\times 12.7$ . 7, Female inflorescence cut lengthwise to show union of perianth with bracts,  $\times 16.4$ . 8, Cells of the leaf margin,  $\times 132$ . 9, Leaf,  $\times 34$ . 10, Antheridium,  $\times 45$ . 11, Tip of leaf lobe,  $\times 175$ . 12, Tip of female shoot with perianth,  $\times 12.7$ . (6, 11, after K. Mueller; 8, after Gil; the others after Pearson.)

old; the lobes acute, sometimes apiculate; sinus acute; margin entire to sinuate; bract cells  $4-21\ \mu$ ; trigones distinct. Perianth slightly shorter than the bracts, delicate; mouth crenulate with long cells. Seta 2-3 cm long. Sporangium subglobose, reddish brown. Elaters up to  $120\ \mu$  long, about  $6\ \mu$  thick, spirals 2, brownish. Spores  $15-18\ \mu$ , reddish brown. Named in honor of its discoverer, Professor Boeck.—On rocks.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 248; Macvicar (374), 110, figs. 1-3; Pearson (433) 2: pl. 171; Carrington, Trans. Bot. Soc. Edinburgh 13: pl. 17, fig. II, 1879; Gil (76) fig. 200.

EXAMINATIONS: None.

TYPE LOCALITY: Mountains of Norway (Boeck) 1869.

RANGE: Greenland (325); Eur. (409).

4. *Marsupella bolanderi*<sup>51</sup> (Aust.) Underw., Zoe 1:365, 1890.

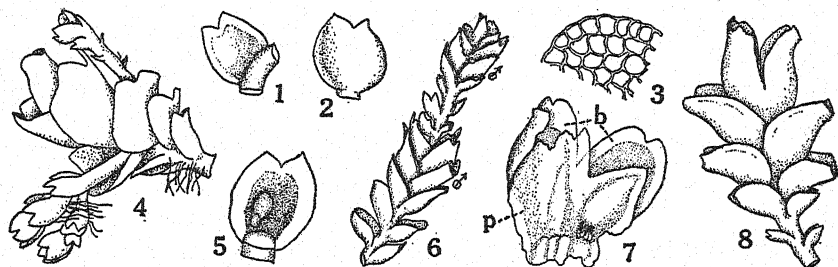
*Sarcoscyphus bolanderi* Aust., Bull. Torr. Bot. Club 3:9, 1872.

*Nardia bolanderi* Underw., Bull. Illinois State Lab. Nat. Hist. 2:113, 1884.

Plants in dense mats, reddish green to dark red or blackish; leafy shoots  $650-950\ \mu$  wide. Stems 2-6 mm long,  $100-220\ \mu$  thick, prostrate to ascending or rarely nearly erect, simple or sparingly branched from base, often innovating below the female inflorescence. Rhizoids usually numerous to near apex, colorless. Leaves somewhat succubous at least below, not decurrent, distant to contiguous, spreading to erect-spreading or of sterile stems somewhat curved toward the dorsal side of the plant, simply 2-lobed, often larger up the stem, concave, ovate-orbicular, usually wider than long,  $140-360\ \mu$  long,  $220-550\ \mu$  wide; lobes tri-

<sup>51</sup> bö län' dër i.

angular-ovate, mostly obtuse; sinus descending  $\frac{1}{4}$ – $\frac{1}{3}$  the leaf length, acute to somewhat obtuse; margin entire to obscurely sinuate or crenate by bulging cells. Cells of the leaf middle 16–36  $\mu$ , mostly rounded-hexagonal; of the margin 16–25  $\mu$ , mostly subquadrate, sometimes somewhat transversely elongate; walls thin; trigones none or obsolete. Plants unisexual; both inflorescences terminal on normal leafy shoots. Male bracts often bordered with somewhat transversely elongate cells, dorsal margin usually somewhat revolute; antheridia 1 or usually 2, on stalks slightly shorter



*Marsupella bolanderi*. 1-2, Leaves, x 21. 3, Cells of leaf margin, x 119. 4, Tip of female shoot with rejuvenations, x 12.7. 5, Male bract with antheridia, x 24. 6, Tip of shoot with two male inflorescences, x 12. 7, Opened perianth (*p*), female bracts (*b*), and archegonia, x 12. 8, Tip of plant, dorsal view, x 12. (All after Howe.)

than the body. Female bracts 4–6 times as large as the leaves, nearly always distinctly crenulate; their marginal cells distinctly elongate transversely and 25–45  $\mu$  long; their median cells 20–50  $\mu$ , oval-elliptic; the bracts obtusely 2-lobed or rarely 3-lobed, usually connate far up and thus forming an involucre which is cylindric or goblet-shaped from an obconic base; the sinuses descending  $\frac{1}{8}$ – $\frac{1}{6}$  the bract length. Perianth united with the bracts for  $\frac{1}{2}$ – $\frac{2}{3}$  its length, subpyriform, a little shorter than the bracts; mouth 4–6-lobed. Seta 2–4 mm long. Sporangium globose, 400–450  $\mu$  thick, dark brown; walls with very many nodular thickenings. Elaters and spores apparently undescribed. Named in honor of Henry Bolander, who first found it.—On moist rocks and banks.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 101, 1899.

EXAMINATIONS: None.

TYPE LOCALITY: California (Bolander).

RANGE: Cal. (296), Ore. (457).

5. *Marsupella sphacelata*<sup>52</sup> (Gieseke) Dum. Rec. d'Obs. 24, 1835.

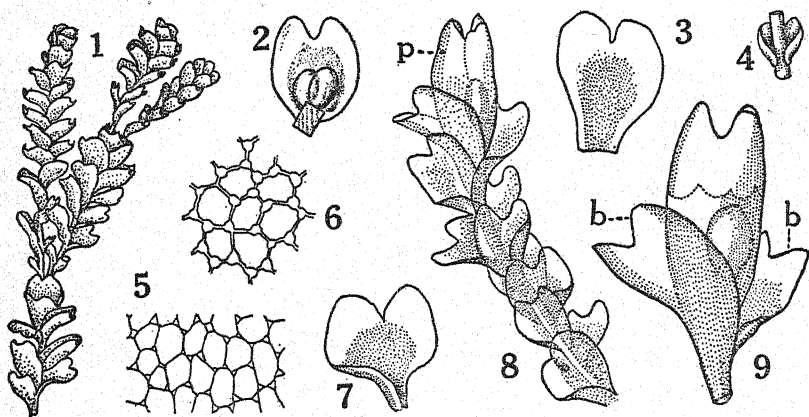
*Jungermannia sphacelata* Gieseke in Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14, Suppl.:76, 1829.

*Marsupia sphacelata* Dum. Syll. Jung. Eur. 78, 1831.

*Sarcoscyphus sphacelatus* Nees Naturg. Eur. Leberm. 1:129, 1833.

*Nardia sphacelata* Carr., Trans. Bot. Soc. Edinburgh 10:378, 1870.

Plants in patches, dull green and usually tinged with brown above; sterile leafy shoots 1.5-2 mm wide. Stems 2.5-4 cm long, thick, flaccid, simple or with few branches, with a tuft of innovations from beneath the female inflorescence; cortical cells hyaline, thin walled, in cross section about twice the area of the interior ones. Rhizoids scarce on stolons as well as on stems, colorless or violet. Leaves transverse or nearly so,



*Marsupella sphacelata*. 1, Part of a plant, x 5. 2, Male bract with antheridia, x 11.3. 3, Leaf, x 11.3. 4, Leaf insertion, x 10.6. 5, Leaf cells, x 185. 6, Cells of the leaf middle, x 186. 7, Leaf, x 22. 8, Tip of shoot with perianth (*p*), x 11.3. 9, Female bracts (*b*) and perianth, x 17. (1, after Gil; 4, after Meylan; 6, after Ammons; 2-3, 5, 7-9, after Pearson.)

not decurrent, distant to subimbricate, larger upward on stem, erect-spreading, simply 2-lobed, embracing and crossing the stem; on sterile stems and innovations hardly larger upward, oblong-quadrate; on fertile stems larger upward, round-quadrate to round-cordate; lobes rounded at tip; sinus descending  $\frac{1}{4}$ – $\frac{1}{3}$  the leaf length, acute, open; margin plane, entire. Cells of the leaf middle 21–28  $\mu$ , 5–6-angled; trigones small but distinct; marginal row thin walled, pale; oil bodies 2–3, spherical to oval. Plants unisexual. Male stems more slender; male inflorescence terminal or farther down; male bracts imbricate, oblong-quadrate, 2-lobed; lobes obtuse; sinus descending  $\frac{1}{4}$ – $\frac{1}{3}$  the bract length, acute. Female inflorescence terminal; female bracts very wide, involute, the margin frequently plicate in the middle, 2-lobed for  $\frac{1}{3}$  the length, tips of the lobes rounded.

<sup>52</sup> sfās ē lā' tā.



Perianth shorter than the bracts, its basal  $\frac{1}{3}$ – $\frac{1}{2}$  united with the bract bases. Seta in cross section of cells about alike in size, 20–30 in the peripheral layer. Sporangium yellowish brown. Spores  $7\ \mu$ , smooth, yellowish brown. Name from the *L. sphacelatus*, withered; in reference to the worn condition of the older leaves.—On wet rocks; in swampy places.

ILLUSTRATIONS: Lindenberg, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14, Suppl.: pl. 1, figs. 9–12, 1829; Ekart (124) pl. 11, fig. 96; Pearson (433) 2: pl. 165; Lorenz, Bryologist 11: pl. 8, 1908; Carrington, Brit. Hep. pl. 2, fig. 5, 1874–1876; K. Mueller (409) 1: fig. 258; Macvicar (374) 120, figs. 1–4; Ammons (3.1) 141, fig. E; Gil (76) fig. 203; Meylan (386) fig. 68.

EXAMINATIONS: Conn. Beacon Falls (Evans) 1890.—Ga. Stone Mt. (Small) date uncertain.—N.H. Lakes of the Clouds (Evans) 1917; Hermit Lake (Underwood & Cook) 1889; Mt. Washington (Underwood & Cook) 1889.—N.S. Cape Breton (Macoun 49) 1898; Yarmouth (Canadian Hepaticae No. 129) 1883.—Pa. Ohiopyle (Conard 1288) 1940.—Vt. Manfield (Lorenz) 1906.

TYPE LOCALITY: Greenland.

RANGE: Greenland (410), Miquelon Isl. (431), N.S. (373), Me. (141), N.H. (141), Vt. (241), Conn. (141), Que. (3.1), Pa., Mont. (81), Alta. (51), Alaska (491), B.C. (373), Ida. (3.1), Wash. (84.2), Cal. (3.1), Tenn. (3.1), Ga. (3.1), N.C. (3.1), Ky. (3.1), W.Va. (3.1), N.J. (504); Asia (491); Eur. (374); Azores (56.58).

5a. *Marsupella sphacelata* var. *erythrorhiza*<sup>53</sup> (Limpr.) Schiffn., Lotos 44:267, 1896.

*Sarcoscyphus sphacelatus* var. *medius* Gottsche, Gottsche & Rabenh. Hep. Eur., Exsic. No. 137, 1860, in part.

*Sarcoscyphus sullivantii* DeNot. Comm. Soc. Crit. Ital. Genova 1:84, 1861.

*Sarcoscyphus ehrhartii* var. *erythrorhizus* Limpr., Cohn Krypt.-Fl. Schlesien 1:248, 1876.

*Sarcoscyphus jacki* Limpr., Cohn Krypt.-Fl. Schlesien 1:248, 1876.

*Sarcoscyphus sphacelatus* var. *erythrorhizus* Limpr., Cohn Krypt.-Fl. Schlesien 1:248, 1876.

*Nardia sphacelata* var. *media* Massal., Ann. Istit. Bot. Roma 2:9, 1886.

*M. erythrorhiza* Schiffn., Lotos 49:48, 1901.

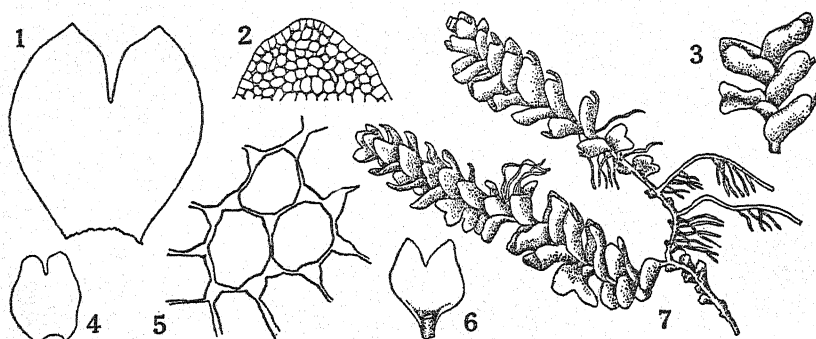
*M. media* Evans, Rhodora 6:167, 1904.

*M. sullivantii* Evans, Rhodora 9:57, 1907.

Stems 1–3 cm long, firm, with rather numerous stolons. Rhizoids numerous on the stolons and on the lower part of stem, scarce on the upper part. Leaves somewhat shining, obcordate, narrow at base; lobes ovate; sinus descending  $\frac{1}{3}$ – $\frac{1}{2}$  the leaf length, narrow, acute. Cells of the marginal row larger, nearly rectangular, 12–16  $\mu$ ; trigones large. Name from the Gk. *erythros*, red, and *rhiza*, root; in reference to the violet color frequently characterizing the rhizoids.—On wet rocks or on wet peaty or mucky soil.

ILLUSTRATIONS: Macvicar (374) 121, figs. 1–4; Lorenz, Bryologist 11: pl. 7, 1908; K. Mueller (409) 1: fig. 257.

<sup>53</sup> ē rŷth" rō ri' ză.



*Marsupella sphacelata* var. *erythrorhiza*. 1, Leaf,  $\times 23$ . 2, Cells of a leaf lobe,  $\times 95$ . 3, Part of a shoot,  $\times 9$ . 4, Leaf,  $\times 22$ . 5, Cells of the leaf middle,  $\times 550$ . 6, Leaf,  $\times 22$ . 7, Plant,  $\times 7.4$ . (1, 5, original, by Helen M. Gilkey; the others after K. Mueller.)

EXAMINATIONS: Conn. Southington (Lorenz) 1913; Hamden (Lorenz) 1915; Hartford (Haynes) 1910.—Me. Mt. Katahdin (Lorenz) 1916.—Mass. Sheffield (Lorenz) 1915.—N.H. Mt. Jocheon (Haycock) date uncertain; Crystal Cascade, White Mt. (Underwood & Cook) 1889; Mt. Choconia (W.G. Farlow) 1907.—N.Y. Lake Minnewaska (Haycock) 1907.—Tenn. Mt. LeConte in Sevier County (Sharp 4132) 1941.—Vt. Mt. Mansfield (Lorenz) 1917.—Wash. Darrington (Frye) 1928; Snoqualmie (Frye) 1929, and (Bailey) 1931.

TYPE LOCALITY: European.

RANGE: N.S. (413), Me. (141), N.H. (141), Vt. (203), Que. (178), N.Y. (59), W.Va. (31), Ky. (218), Tenn., Ga. (212), N.C. (12), Conn. (141), Mass. (141), Mich. (483); B.C. (46.1), Wash. (81), Cal. (202); Eur. (374).

Joergensen (325) does not consider this distinct from *M. sphacelata*.

6. *Marsupella sparsifolia*<sup>54</sup> (Lindb.) Dum. Hep. Eur. 128, 1874.

*Sarcoscyphus sparsifolius* Lindb., Not. Saellsk. Fauna Fl. Fennica Foerh. 9:280, 1868.

*Nardia sparsifolia* Lindb. Musci Scand. 10, 1879.

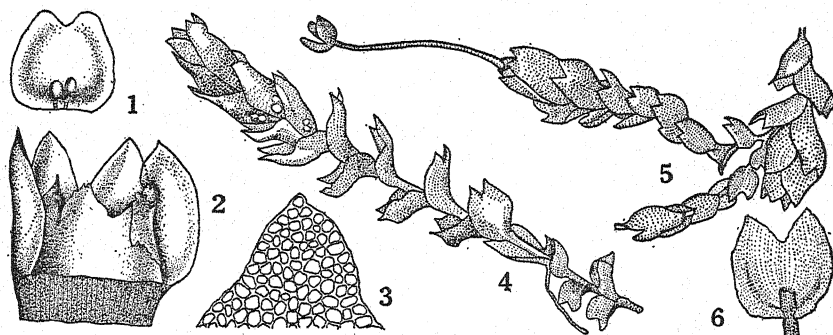
*Sarcoscyphus styriacus* Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 58:180, 1881.

*M. styriaca* Kaal., Nyt. Mag. Naturvid. 33:416, 1893.

Plants in mats, purplish brown to nearly black, rarely pale; leafy shoots 1-2 mm wide. Stems 0.5-3 cm long, erect, simple to much branched, often innovating from below the inflorescence. Rhizoids scarce, colorless or pale rose. Leaves inserted transversely or nearly so, not decurrent, distant to somewhat overlapping, erect-spreading to almost squarrose, simply 2-lobed, ovate-cordate to almost circular, half clasping the stem, slightly shining, nearly the same size up and down the stem; lobes broadly ovate, usually obtuse but sometimes subacute; sinus acute, open, descending  $\frac{1}{4}$ - $\frac{1}{3}$  the leaf length. Cells of leaf middle 16-24  $\mu$ , of the apical region 12-14  $\mu$ , rounded-hexagonal; trigones large, distinct. Plants

<sup>54</sup> spär si f8' II 8.

bisexual. Male inflorescence below the female on the same stem; male bracts rather large, concave; antheridia 1-4. Female inflorescence terminal; female bracts connate for about  $\frac{1}{2}$  length from base, the lobes acute. Perianth united with the bracts for about  $\frac{1}{4}$  its length, ovoid, immersed in the large female bracts. Seta 1-5 mm long,  $200\ \mu$  thick, in



*Marsupella sparsifolia*. 1, Male bract with antheridia,  $\times 16.4$ . 2, Female bracts with part of the perianth between them,  $\times 16.4$ . 3, Tip of a leaf lobe,  $\times 116$ . 4, Tip of shoot with antheridia,  $\times 2.6$ . 5, Part of plant with sporophyte,  $\times 2.6$ . 6, Leaf,  $\times 8$ . (1-2, after Pearson; 3-6, after K. Mueller.)

cross section with 15 peripheral cells which are about twice the area of the interior ones. Sporangium spherical, brown, opening by 4 valves; its inner wall layer with semiannular thickenings here and there. Elaters much contorted,  $10-12\ \mu$  thick; spirals 2, brown. Spores  $8-15\ \mu$ , minutely granular, brown. Name from *L. sparsus*, scattered, and *folium*, leaf; referring to the rather distant leaves.—On granitic rock; on sandy gravelly noncalcareous ground.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 245; Pearson (433) 2: pl. 169; Macvicar (374) 112, figs. 1-3.

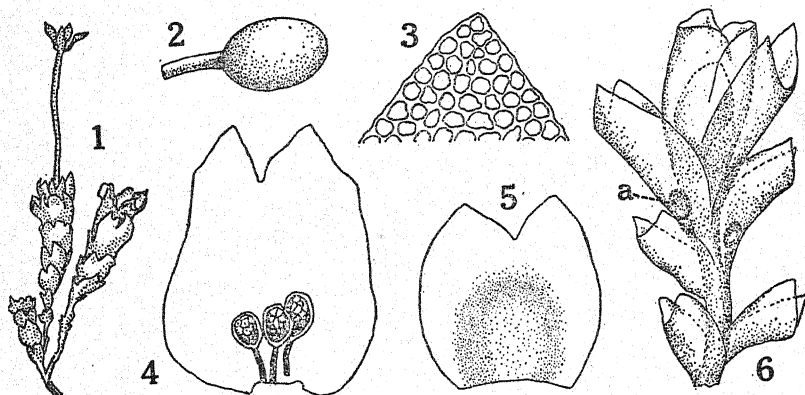
EXAMINATIONS: *Alta.* Storm Mountain (Brinkman 962) 1913.

TYPE LOCALITY: Scandinavian Peninsula.

RANGE: N.S. (53.2), N.H. (142), Mich. (419.01), *Alta.* (51), B.C. (96); Eur. (409).

7. *Marsupella ustulata*<sup>55</sup> (Hueben.) Spruce, Revue Bryol. 8:100, 1881.*Jungermannia ustulata* Hueben. Hep. Germ. 132, 1834.*Sarcoscyphus adustus* Spruce, Trans. Bot. Soc. Edinburgh 3:196, 1850.*Nardia adusta* Carr. Brit. Hep. 20, 1874.*Nardia brevissima* Lindb. Musci Scand. 9, 1879.*Nardia ustulata* Spruce, Revue Bryol. 8:100, 1881.*Sarcoscyphus sprucei* var. *decipiens* Limpr., Flora 64:75, 1881.*Sarcoscyphus ustulatus* Kiaer, Christiania Vid. Selsk. Forh. 82, 1885.*Sarcoscyphus neglectus* var. *ustulatus* Breidl., Mitt. Naturw. Ver. Steiermark 30:283, 1893.

Plants in patches, green to black; sterile leafy shoots about 350  $\mu$  wide. Stems 1-5 mm long, creeping to suberect, simple or with few branches, sometimes forming branches from beneath the inflorescence. Rhizoids numerous, colorless. Leaves inserted transversely or nearly so, not decurrent, contiguous to somewhat imbricate, erect to erect-spreading, simply 2-lobed, broadly oval, 310-400  $\mu$  long, twice as wide as the stem,



*Marsupella ustulata*. 1, Part of plant with sporophyte, x 8.5. 2, Antheridium, x 120. 3, Leaf tip, x 282. 4, Male bract with three antheridia, x about 56. 5, Leaf, x 45. 6, Tip of shoot bearing antheridia (a), x 45. (1, 3-4, after K. Mueller; 2, 5-6, after Pearson.)

gradually larger up the stem; lobes ovate-acute or triangular-acute but sometimes blunt; sinus acute to right-angular, descending  $\frac{1}{4}$ - $\frac{1}{3}$  the leaf length. Cells of the leaf middle 12-18  $\mu$ , of the margin 8-10  $\mu$ , rounded-hexagonal; walls fairly thick; trigones none to rarely distinct; oil bodies 2-4, large. Plants bisexual. Male inflorescence beneath the female; male bracts  $\frac{1}{3}$  or more connate, the lobes mostly obtuse; antheridia 1-3. Female inflorescence terminal; female bracts connate about  $\frac{1}{3}$  the length, grading from leaves in size, longer and wider than the leaves, cordate at base, the lobes usually obtuse; sinus acute, descending  $\frac{1}{8}$ - $\frac{1}{5}$  the bract length. Perianth connate with base of bracts for  $\frac{1}{3}$  its length, ovoid, much shorter than the bracts; mouth small, crenulate. Seta 2-3 mm long. Spo-

<sup>55</sup> üs tü lä' tä.



rangium spherical, reddish brown; both its wall layers without semi-annular thickenings. Elaters about  $100\ \mu$  long,  $7-11\ \mu$  thick; spirals 2, reddish brown. Spores  $9-12\ \mu$ , nearly smooth, pale reddish brown. Name from the *L. ustulata*, burnt; probably on account of the commonly nearly black color of the plants.—On soil and rocks at high altitudes.

ILLUSTRATIONS: Schiffner (458) fig. 41; Pearson (433) 2: pl. 168; K. Mueller (409) 1: fig. 247; Macvicar (374) 114, figs. 1-4; Meylan (386) fig. 65; Carrington, Brit. Hep., pl. 2, fig. 6 (5-9), 1874.

EXAMINATIONS: *Me.* Chimney Pond, Mt. Katahdin (Lorenz) 1916.—*N.H.* Mt. Washington (Evans) 1917; Mt. Madison (Evans) 1917; White Mt. (Underwood & Cook) 1889.—*Wash.* Stevens Pass (Frye) 1934.—*Wyo.* Centennial (Frye) 1931.

TYPE LOCALITY: Bogneres-de-Bigonne in the Pyrenees Mountains, 1845.

RANGE: N.S. (413), *Me.* (155), N.H. (169), *Wyo.* (83) by error as *M. ustula*, B.C. (46.1), *Wash.* (84.2), *Ore.* (457); *Eur.* (409).

#### 8. *Marsupella emarginata*<sup>56</sup> (Ehrh.) Dum. Comm. Bot. 114, 1822.

*Jungermannia emarginata* Ehrh. Beitr. 3:80, 1788.

*Jungermannia macrorrhiza* Dicks. Pl. Crypt. Brit., Fasc. 2:16, 1790.

*Jungermannia pulvinata* Raddi, Mem. Soc. Ital. Sci. Modena 19:28, 1820, according to K. Mueller.

*Nardius emarginatus* S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821.

*Sarcoscyphus ehrharti* Corda, Opiz, Beitr. 652, 1828.

*Sarcoscyphus densifolius* Nees Naturg. Eur. Leberm. 1:131, 1833.

*M. densifolia* Dum. Rec. d'Obs. 24, 1835.

*Sarcoscyphus piceus* DeNot., Comm. Soc. Crit. Ital. Genova 1:?, 1861, in part, according to K. Mueller.

*Sarcoscyphus emarginatus* Hartm. Skand. Fl., Ed. 10, 2:128, 1871.

*Nardia emarginata* var. *picea* Carr. Brit. Hep. 14, 1874.

*Nardia emarginata* Lindb., Acta Soc. Sci. Fennica 10:531, 1875.

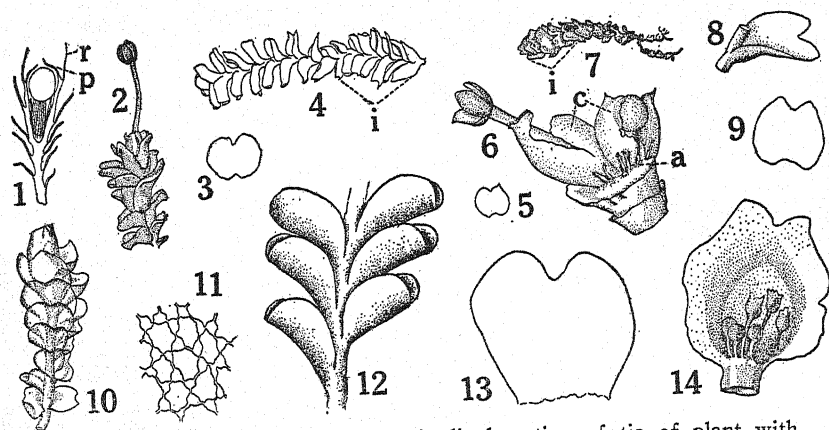
*Nardia densifolia* Lindb. Musci Scand. 41, 1879.

*Nardia picea* Massal., Rep. Epat. Ital. 62, 1886, according to K. Mueller.

*M. emarginata* var. *densifolia* Breidl. in Mitt. Naturw. Ver. Steiermark 286, 1893.

Plants in loose or dense mats, green or yellowish to reddish brown or purple; leafy shoot 1-1.5 mm wide. Stems 1-7 cm long, usually simple, frequently innovating below the female inflorescence, erect or suberect, firm; cortical cells usually thick walled, in size about the same as the interior ones. Rhizoids almost confined to the stolons and to the bases of the stems, colorless or occasionally tinged with violet. Leaves transversely inserted, not decurrent, approximate to subimbricate, somewhat clasping, erect-spreading to nearly horizontal, simply 2-lobed, quadrate-orbicular, firm, strongly concave,  $300-900\ \mu$  long and wide, but little larger up the stem; margin entire, reflexed on the dorsal side of the plant; lobes obtuse or obtusely pointed; sinus descending  $\frac{1}{6}-\frac{1}{4}$  the leaf length, wide, obtuse. Cells of the leaf middle  $6-28\ \mu$ , rounded-hexagonal; near the margin smaller, oblong; walls usually only slightly thickened; trigones distinct, triangular; cuticle smooth. Plants unisexual; both the inflorescences

<sup>56</sup> ē mār' jī nā' tā.



*Marsupella emarginata*. 1, Longitudinal section of tip of plant with sporophyte, perianth (*p*), and female bracts (*r*),  $\times 4.4$ . 2, Tip of female plant with sporophyte,  $\times 2.8$ . 3, Leaf,  $\times 4.4$ . 4, Tip of male plant with inflorescence (*i*),  $\times 4.4$ . 5, Leaf,  $\times 4.4$ . 6, Female tip dissected showing calyptra (*c*), and archegonia (*a*),  $\times$  about 5. 7, Male plant with inflorescence (*i*),  $\times 2.5$ . 8, Leaf,  $\times$  about 16. 9, Leaf,  $\times 13.2$ . 10, Tip of shoot with perianth,  $\times 8.5$ . 11, Leaf cells,  $\times 247$ . 12, Part of sterile shoot,  $\times 20$ . 13, Leaf,  $\times 27$ . 14, Male bract with six antheridia,  $\times 21$ . (1, 3-5, after Jensen; 2, 7, 14, after K. Mueller; 6, 8, after Hooker; 9, 11, after Meylan; 10, after Pearson; 12-13, original, by Elsie K. Waddingham.)

terminal on main stems. Male bracts 6-8, imbricate, ventricose, often with acute sinuses and lobes, with broadly reflexed dorsal margin; antheridia 3-5, oval, with rather long stalk. Female bracts erect, connate to the middle, somewhat larger than the leaves but with lobes and sinuses almost similar to them. Perianth slightly shorter than the bracts and united with them to above its middle, the free portion shallowly 4-6-lobed. Sporangium ovoid-globose, brown; epidermal cells with distant band-like thickenings; inner layer of the wall with crowded band-like thickenings. Elaters reddish brown; spirals 2. Spores 10-13  $\mu$ , finely granulate, reddish brown. Name from *L. emarginatus*, without a margin; apparently in reference to the shallowly indented margin of the involucre.—On rocks and damp walls or on exposed banks.

ILLUSTRATIONS: Hooker (285) pl. 27; Ekart (124) pl. 7, fig. 56, and pl. 13, fig. 113; Underwood (506) pl. 23; Pearson (433) 2: pl. 163; K. Mueller (409) 1: figs. 240-242, 254; Macvicar (374) 116, figs. 1-4; Meylan (386) fig. 69; Warnstorff (523) 141, fig. 3; Jensen (323.5) 79, 7 figs.; Ammons (3.1) 141, fig. D.

EXAMINATIONS: B.C. Hope (Frye) 1928.—Conn. Beacon Falls (Evans) 1905.—Me. Mt. Bigelow (Collins 1517) 1896.—Minn. St. Louis County (Conklin) 1922; Duluth (Conklin) 1916.—N.H. Waterville (Lorenz 67) 1906; Randolph (Evans) 1917; Mt. Adams (Evans) 1917.—N.C. Mt. Mitchell in Yancey County (P. C. Standley and H. C. Bollman 10402) 1913.—N.Y. Panther Mountain in Herkimer County (Haynes) 1905; Little Moose Lake in Herkimer County (Haynes) 1916.—Wash. Mt. Rainier (Bailey) 1929; Darrington (Frye) 1932; Mt. Rainier National Park (Frye) 1934.

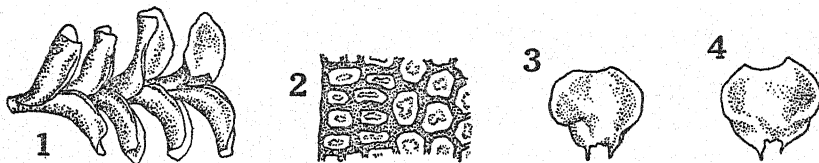
TYPE LOCALITY: European.

RANGE: Labrador (510), Miquelon Isl. (431), N.S. (413), N.B. (373), Me. (366), N.H. (355), Vt. (169), N.Y. (258), Que. (485.6), Pa. (338), Mich. (419), Minn. (212), Alta. (373), Yukon (298), Alaska (373), B.C. (373), Mont. (82), Wash. (81), Ore. (215), Cal. (296), Colo. (175), Tenn. (3.1), N.C. (480), Va. (127), Ky. (218), W.Va. (386.5), Conn. (212), Mass. (169); Asia (212); Eur. (458); Canary Islands (15.1).

8a. *Marsupella emarginata* var. *pearsonii*<sup>57</sup> (Macv.) Joerg., Bergens Mus. Skrift. 16:78, 1934.

*M. pearsonii* Macvicar, Jour. Bot. London 43:117, 1905.

Leaves inclined to be widest above their middle; sinus from almost none to descending about  $\frac{1}{10}$  the leaf length. Walls of cells of leaf margin much thickened. Named in honor of W. H. Pearson, a British botanist, who first gathered it.—On rocks in marshy places in subalpine regions.



*Marsupella emarginata* var. *pearsonii*. 1, Part of leafy shoot, dorsal view, x 12.7. 2, Cells of the leaf margin, x 254. 3-4, Leaves, x 12.7. (All after Macvicar.)

ILLUSTRATIONS: Macvicar (374) 117, figs. 1-3.

EXAMINATIONS: None.

TYPE LOCALITY: Borrowdale, Cumberland, England (Pearson) 1893.

RANGE: B.C.<sup>57a</sup> (51); Eur. (325).

8b. *Marsupella emarginata* var. *aquatica*<sup>58</sup> (Lindenb.) Dum. Hep. Eur. 126, 1874.

*Jungermannia emarginata* var. *aquatica* Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14, Suppl.: 75, 1829.

*Sarcoscyphus ehrhartii* var. *aquatica* Nees Naturg. Eur. Leberm. 1:125, 1833.

*Jungermannia emarginata* var. *grandis* Hueben. Hep. Germ. 124, 1834.

*Sarcoscyphus ehrhartii* var. *robustus* DeNot., Comm. Soc. Crit. Ital. Genova 1:80, 1861.

*Nardia emarginata* var. *major* Carr. Brit. Hep. 14, 1874.

*Nardia emarginata* var. *aquatica* Carr. Brit. Hep. 14, 1874.

*M. robusta* Carr. Brit. Hep. 16, 1874.

*Nardia robusta* Trev., Mem. Istit. Lomb., Ser. 3, 4:400, 1877.

*Sarcoscyphus aquaticus* Breidl., Mitt. Naturw. Ver. Steiermark 30:286, 1893.

*M. aquatica* Schiffn., Lotos 44:267, 1896.

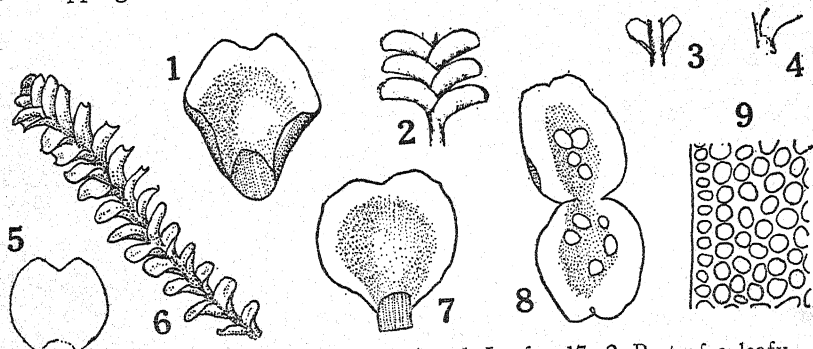
*M. emarginata* var. *robusta* Pears. Hep. Brit. Isles 1:376, 1902.

<sup>57</sup> pēr' sōn i i.

<sup>57a</sup> We believe the report from British Columbia may be an error of determination. We have no material from America to examine.

<sup>58</sup> ā kwāt' ik ā.

Stems usually 3-10 cm long, robust, erect. Lobes of leaves rounded at tip; sinus wide, rounded at base, descending about  $\frac{1}{8}$  the leaf length; margin near base slightly revolute. Cells of the leaf middle  $18-26 \mu$ ; walls plainly thickened; trigones none to conspicuous. Sporangium oblong-cylindric. The name from its habitat in water or very wet places.—On dripping rocks or submerged in streams or margins of lakes.



*Marsupella emarginata* var. *aquatica*. 1, Leaf,  $\times 17$ . 2, Part of a leafy shoot,  $\times 12$ . 3-4, Leaf insertion,  $\times 12$ . 5, Leaf spread out,  $\times 14.8$ . 6, Leafy shoot, dorsal view,  $\times 5$ . 7, Leaf,  $\times 17$ . 8, Two male bracts with antheridia,  $\times 17$ . 9, Cells of the leaf margin,  $\times 176$ . (1, 7-8, after Pearson; 2-5, after Meylan; 6, 9, after Gil.)

ILLUSTRATIONS: Macvicar (374) 119, figs. 1-3; K. Mueller (409) 1: figs. 255-256; Gil (76) fig. 202; Pearson (433) 2: pl. 164.

EXAMINATIONS: Newfoundland. Beschey Lakes (A. R. Northcop 25) 1911.—N.Y. Mt. Marcy (Lorenz 29) 1915.

TYPE LOCALITY: European.

RANGE: Greenland (322), Newfoundland (431), N.S. (413), Me. (141), N.H. (141), N.Y.; Eu. (374).

We have not seen *M. aquatica* var. *gracilis* C. Jensen, Medd. om Groenland 30:310, 1906. The description does not seem to us to warrant a variety. We consider it as probably a deeply submerged form of the var. *aquatica*.

8c. *Marsupella emarginata* var. *arctica*<sup>59</sup> (Bergg.) n. comb.

*Sarcoscyphus emarginatus* var. *arcticus* Bergg., Kgl. Sv. Vet.-Akad. Handl. 13:96, 1875.

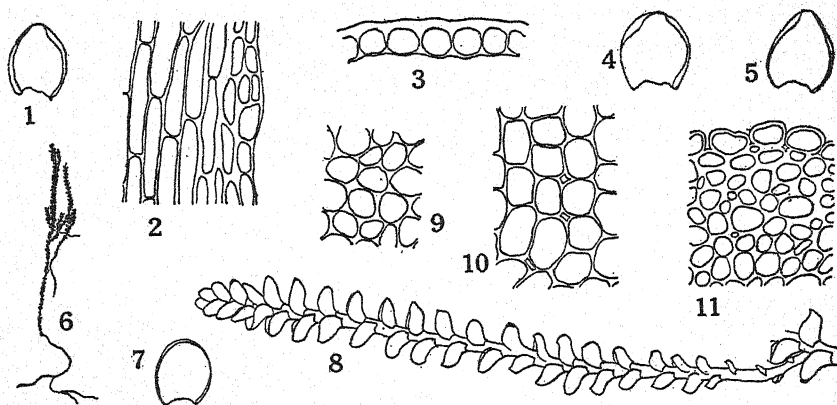
*Marsupella arctica* Bryhn & Kaal., in Bryhn, Rept. 2nd Norwegian Arctic Exped. in "Fram" 1898-1902, 11:26, 1906.

*Marsupella groenlandica* C. Jens., Medd. om Groenland 30:291, 1906.

Plants forming rather dense mats similar to those of *Gymnomitrium revolutum*, black to purplish brown; leafy shoots 0.5-1 mm thick. Stems 1.5-6 cm long, freely branched from the base, with numerous leafless stolons; epidermal cells larger than the interior ones, with walls quite

<sup>59</sup> ärk' ti kä.





*Marsupella emarginata* var. *arctica*. 1, Leaf,  $\times 14$ . 2, Part of longitudinal section of stem,  $\times 185$ . 3, Part of cross section of leaf showing thick dorsal cell walls,  $\times 185$ . 4-5, Leaves,  $\times 14$ . 6, Male plant,  $\times 0.5$ . 7, Leaf,  $\times 14$ . 8, Male branch,  $\times 6.4$ . 9, Leaf cells,  $\times 185$ . 10, Epidermal cells of the stem,  $\times 185$ . 11, Part of cross section of the stem,  $\times 185$ . (All after Jensen.)

thick, their outer surfaces bulging. Leaves almost circular when flattened out, about  $500\ \mu$  long, little or not at all narrowed at base; lobes rounded at tip; sinus shallow to hardly present; margin often colorless, slightly involute. Cells of the leaf middle about  $20\ \mu$ , of the apical region  $10\text{--}15\ \mu$ ; walls thickened on the dorsal side of the leaf and in the cell angles. Male bracts 5-7, similar to the leaves; antheridium 1. Female inflorescence and sporophyte not known. Name from the arctic locality in which the type material was found.—On wet slimy rocks.

ILLUSTRATIONS: Jensen, Medd. om Groenland 30:292-293, figs. 1-11, 1906.

EXAMINATIONS: None.<sup>50a</sup>

TYPE LOCALITY: Smeerenberg and Kobbe Bay, Spitzbergen (Berggren).

RANGE: Ellesmere Island (56.01), Greenland (321); Spitzbergen (409).

PRASANTHUS<sup>50</sup> Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):62, 1889.

*Gymnomitrium* Gottsche, Fl. Danica 16:20, 1871, in part.

*Cesia* Lindb. Musci Scand. 9, 1879, in part.

*Notoscyphus* Steph., Bull. Herb. Boissier, Ser. 2, 1:171, 1901; also Sp. Hep. 2:32, 1901, in part.

Plants very densely leafy. Stems creeping, some of the branches penetrating the soil; these branches leafless, root-like in appearance. Rhizoids numerous. Leaves alternate, transversely inserted but appearing incubous in their overlapping. Underleaves very small. Plants bisexual. Antheridia in axils of bracts below the female ones, solitary. Female

<sup>50a</sup> We have seen Spitzbergen material with type locality label, but none from Greenland.

<sup>50</sup> präs än' thūs.

inflorescence onion-like in form; bracts connate only at base, lacinate with age. Perianth none. Calyptra purplish red at tip. Seta from within a pocket-like perigynium formed by the end of the stem; perigynium with base on or in the earth, densely rhizoidous on under side. Sporangium opening by 4 valves which may again split to form 5-7; wall of 2 layers of cells; epidermal layer with nodular thickenings; inner layer with semi-annular thickenings. Name from Gk. *prason*, leek, and *anthos*, flower; apparently referring to the onion-like female inflorescence.

There is only the following species.

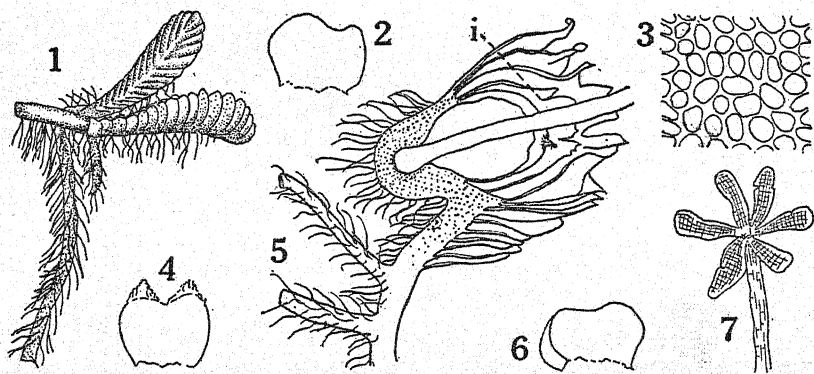
1. *Prasanthus suecicus*<sup>61</sup> (Gottsche) Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):62, 1889.

*Gymnomitrium suecicum* Gottsche, Fl. Danica 16:20, 1871.

*Cesia suecica* Lindb. Musci Scand. 10, 1879.

*Notoscyphus suecicus* Steph., Bull. Herb. Boissier, Ser. 2, 1:173, 1901; also Sp. Hep. 2:34, 1901.

Plants in dense mats, grayish green, entangled by their root-like branches; leafy branches clavate, 150-300  $\mu$  thick. Stems up to 5 mm long, creeping; some of the branches leafless, root-like, penetrating the soil. Rhizoids numerous, not in tufts. Leaves alternate, transversely inserted but overlapping somewhat incubously, not decurrent, imbricate, closely applied to each other to their tips, simply somewhat 2-lobed, rather wider than long, somewhat roundish; lobes rounded at tip; sinus descending  $\frac{1}{8}$ - $\frac{1}{5}$  the leaf length, obtuse to roundish or crescentic; margin and lobes hyaline; margin entire. Cells of the leaf middle 20-25  $\mu$ , of the margin about 10  $\mu$ , of the base about 20 by 60  $\mu$ ; walls somewhat thickened; trigones small; oil bodies none; cuticle smooth. Gemmae apparently



*Prasanthus suecicus*. 1, Part of plant with two descending root-like rhizoidous branches, x21. 2, Leaf, x28. 3, Cells of the leaf middle, x141. 4, Leaf with dead hyaline lobes, x28. 5, Longitudinal section through the perigynium, showing involucre of female bracts (*i*), x28. 6, Leaf, x28. 7, Open sporangium, x28. (All after K. Mueller.)

<sup>61</sup> swē'si kūs.

unknown. Underleaves oval, unlobed to 2-lobed, much smaller than the leaves, present only here and there on the stem. Plants bisexual. Male bracts below the female ones on the same stem, larger than the leaves of sterile stems; antheridia 1 per bract. Female inflorescence terminal on a main shoot, the tip of the stem becoming perigynium-like; female bracts larger than the leaves of sterile stems, free from each other, becoming cleft into 3-4 lobes, hyaline, the margins recurved; bracteole lanceolate, crenulate. Perianth wanting. Perigynium short, cup-like, fleshy, densely rhizoidous outside, becoming erect. Calyptra purplish red. Seta about 5 mm long. Sporangium ovoid, valves straight, wall of 2 layers of cells; epidermal cells with nodular thickenings; inner layer with yellowish brown semiannular thickenings. Elaters 6-8  $\mu$  wide; spirals 2, loosely wound, reddish brown. Spores 12-14  $\mu$ , finely granulate, reddish brown. The name from Sweden, the country in which it was first found.—On bare glacial soil in high mountains.

ILLUSTRATIONS: K. Mueller (409) 1: figs. 96, 259; Gottsche, Fl. Danica 16 (48): pl. 2870, fig. 2, 1871.

EXAMINATIONS: None.

TYPE LOCALITY: Sweden.

RANGE: Greenland (322); northern Asia (458); Eur. (409).

#### LOPHOCOLEOIDEAE<sup>62</sup>

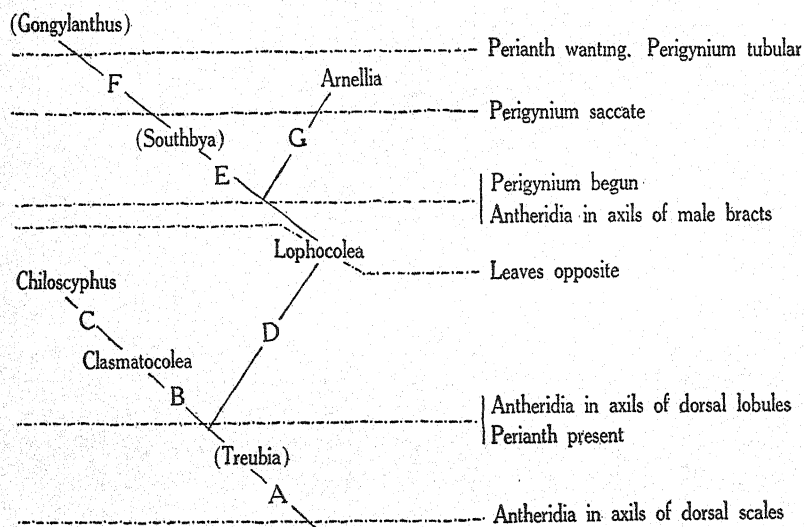
Branches various in origin. Rhizoids in tufts near bases of underleaves, sometimes in their axils, sometimes their tips lobately branched. Leaves alternate or opposite, succubous, dorsally decurrent, unlobed to 2-lobed, the lobes acuminate to rounded; margin of leaves of sterile stems mostly entire, in occasional species ciliate-spinose; margins of leaves below female bracts often more or less toothed. Cell walls thin, the cell cavity angular; trigones wanting or small. Underleaves usually present throughout and rather large but in some species even wanting, free or connate with 1 or 2 leaves, nearly always 2-lobed or 4-lobed, the larger two lobes in nearly all species lanceolate to subulate. Plants unisexual or more commonly bisexual. Male inflorescence most commonly on a branch or constituting the whole of one; male bracts with an antheridial lobule on the base of the dorsal margin; antheridia 1-2 per bract. Female inflorescence on a normal leafy shoot or constituting the whole of a very short branch. Perianth from hardly to very sharply 3-4-angular; mouth wide. Seta in cross section of numerous and very similar cells so far as known. Sporangium globose to ovoid, the wall of 3-5 layers of cells.

The group is held together by the comparatively large and distinct dorsal antheridial lobule. The dorsal location of the antheridia suggests

<sup>62</sup> lō' fō kō' lē ôi' dē ē.

a low group. Most leafy liverworts have the antheridia well within the axils of bracts but here they are under the dorsal modified part. The disturbing element in the grouping of the genera is that they differ so greatly in the origin of the branches. It is conceivable that the dorsal lamellae of some *Petalophyllum*-like ancestor, and the dorsal scales of *Treubia* are homologous. It is possible that the dorsal antheridial lobule is the remains of the dorsal scale of a *Treubia*-like ancestor.

- Branches arising in the axils of lateral leaves; underleaves wanting in some species, common in others; female inflorescence on a normal leafy shoot; perianth 3-4-angled..... *Clasmatocolea*, p. 237.
- Branches arising just behind the ventral margin of the leaves; underleaves common or present throughout; female inflorescence constituting a very short branch; perianth hardly angular; leaves alternate..... *Chiloscyphus*, p. 239.
- Branches arising between the leaf and underleaf; on sterile stems most of the leaves with acute or acuminate lobes; some species with opposite leaves..... *Lophocolea*, p. 250.



Phylogenetic diagram of North American Lophocoleoideae and Southbyoideae.

#### RELATIONSHIPS AMONG NORTH AMERICAN LOPHOCOLEOIDEAE AND SOUTHBYOIDEAE

The statements under the letters below are pertinent at corresponding letters on the diagram above:

(A) Perianth wanting, pseudoperianth present; underleaves wanting; archegonia in the axils of dorsal scales.

(B) Branches from the ventral half of the leaf axil; underleaves



wanting to rudimentary on sterile shoots, free when present; archegonia terminal.

(C) Branches from behind the ventral margin of the leaf; underleaves present, free; female inflorescence constituting a short lateral branch without normal leaves. Sporangial wall 3-4 cells thick; structure of seta unknown.

(D) Branches from between a leaf and underleaf; underleaves present, free or united with one or both adjacent leaves. Sporangial wall 4-5 cells thick; seta of numerous and very similar cells.

(E) Origin of branches uncertain; underleaves in the female inflorescence only, small, free. Sporangium ovoid, its wall 2 cells thick.

(F) Archegonia terminal but at the bases of the dorsal margins of the terminal pair of leaves; underleaves wanting. Sporangium rather long cylindric.

(G) Branches from the axils of underleaves; underleaves quite common, very small, free; marginal row of leaf cells with thick walls. Sporangium ovoid, its wall 2 cells thick.

**CLASMATOCOLEA**<sup>63</sup> Spruce, Trans. Bot. Soc. Edinburgh 15:440, 1885.

Plants often in patches or mats, brownish green to green. Stems short, suberect, fragile, densely leafy; branches none or few to many and pinnate, ascending, originating in the axils of lateral leaves; subfloral innovations wanting. Rhizoids numerous from the base to near the apex, in tufts at the bases of the underleaves. Leaves alternate, quite succubous, somewhat dorsally decurrent, erect-spreading when young, horizontally spreading when mature, unlobed to slightly 2-lobed, roundish, widest above or below the middle, wide at insertion, the margins entire; sinus from wanting to a deep emargination. Walls of leaf cells thin or little thickened. Underleaves wanting to large, obliquely spreading, occasional ones sometimes 2-lobed. Plants unisexual or bisexual. Male inflorescence when on branched stems terminal on ordinary leafy branches; male bracts lax, deeply and roundedly concave; the antheridial lobule present at base of dorsal margin, small, incurved toward the stem and toward the ventral side; antheridium 1 per bract. Female bracts similar to the foliage leaves, large, entire to 2-lobed; bracteole wanting to large. Perianth large for the plant, obovoid to oblong-campanulate, fragile, obtusely 3-4-plicate, two of the plicae always lateral; mouth wide, truncate, entire to irregularly sinuate-lobed. Seta short. Sporangium small, globose, 4-valved to base, the valves with semiannular thickenings. Elaters with 2 spirals; spirals loosely wound, often represented by distant rings. Spores small, tuber-

<sup>63</sup> klās"-mā tō kō' lě ä.

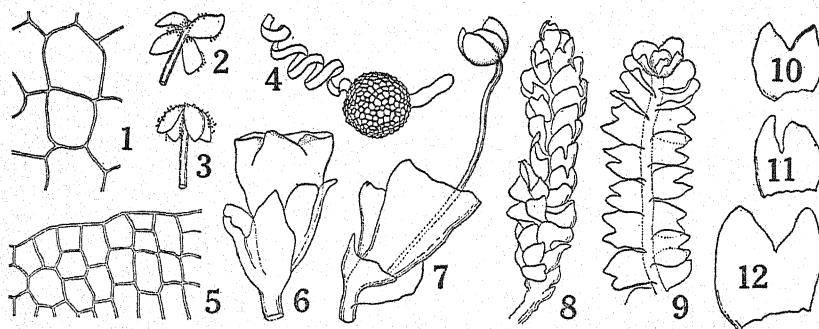
culate, unknown in most species. The name from Gk. *klasma*, a fragment, and *kolea*, sheath; in reference to the fragile broken perianths.

Plants bisexual; leaves 2-lobed for  $\frac{1}{4}$ – $\frac{1}{3}$  their length; branches wanting or few; underleaves wanting on sterile stems. . . . . 1. *C. doellingeri*.  
Plants unisexual; leaves 2-lobed for  $\frac{2}{3}$  their length; branches numerous; underleaves rudimentary on sterile stems. . . . . 2. *C. exigua*.

1. *Clasmatocolea doellingeri*<sup>64</sup> (Nees) Steph., Bull. Herb. Boissier, Ser. 2, 6:391, 1906; also Sp. Hep. 3:47, 1906.

*Jungermannia doellingeri* Nees, in G.L. & N. Syn. Hep. 104, 1844.

Plants in dense patches, green. Stem up to 5 mm long, creeping, delicate, green, fragile; branches wanting or few. Leaves alternate, quite succubous, slightly decurrent dorsally, contiguous to slightly imbricate, erect-spreading to spreading, horizontal or almost so, simply 2-lobed, broadly ovate to roundish, concave, wide at base; margins entire; lobes often unequal with the ventral the larger, widely triangular, acute to rounded; sinus descending  $\frac{1}{4}$ – $\frac{1}{3}$  the leaf length, acute to obtuse. Cells



*Clasmatocolea doellingeri*. 1, Cells of leaf middle, x 598. 2-3, Ruptured sporangia, x 22. 4, Spiral of elater, and germinating spore, x 598. 5, Cells at mouth of perianth, x 300. 6, Tip of shoot with perianth, x 21. 7, Tip of shoot with sporophyte, x 21. 8, Antheridial branch, x 21. 9, Sterile shoot, dorsal view, x 21. 10-12, Leaves, x 51. (All original, by Elizabeth Curtis.)

near the tips of the leaves about  $18\ \mu$ , near the base  $18$ – $27\ \mu$ ; walls thin; trigones wanting. Gemmae unknown. Underleaves wanting except just below the female bracteole. Plants bisexual. Male bracts small, 10 or fewer, rather loosely imbricate, concave, 2-lobed for about  $\frac{1}{3}$  the bract length, the dorsal lobe commonly smaller; the lobes ovate, acute to rounded; the sinus acute to right-angular. Female bracts larger than the leaves of sterile stems, rounded-ovate, 2-lobed for  $\frac{2}{5}$ – $\frac{1}{2}$  the length, quite concave, the lobes and the sinus acute to rounded; bracteole narrowly ligulate, somewhat obtuse. Perianth usually an inverted cone, large, widest at mouth; mouth truncate, entire to sinuate-lobed. Seta short. Sporan-

<sup>64</sup> d'él' ling ér i.

gium globose. Elaters short; spirals 2, loosely coiled, often represented only by distant rings. Spores about  $12\ \mu$ , tuberculate, reddish. Named in honor of its original collector, Doellinger.—On bark; on roots and logs.

ILLUSTRATIONS: None.

EXAMINATIONS: Fla. Sanford (S. Rapp) 1934.

TYPE LOCALITY: Rio de Janeiro, Brazil (Doellinger).

RANGE: Fla. (266); S. Amer. (491).

2. *Clasmatocolea exigua*<sup>65</sup> Steph., Bull. Herb. Boissier, Ser. 2, 6:391, 1906; also Sp. Hep. 3:47, 1906.

Plants in dense patches, olive green; leafy shoots slender. Stems 3-4 mm long, slender, green, fragile; branches numerous, long, the upper irregularly pinnate. Leaves alternate, quite succubous, somewhat decurrent dorsally, distant to contiguous, from horizontally spreading on well developed shoots to erect spreading on younger shoots, all the larger ones obcordate, simply 2-lobed; margins entire; lobes wide, obtuse to rounded; sinus descending about  $\frac{2}{3}$  the leaf length, narrow, acute to obtuse. Cells near the tips of the leaves about  $15\ \mu$ , near the base about  $20\ \mu$ ; walls thin; trigones wanting. Gemmae unknown. Underleaves rudimentary, subulate, about 3 cells long, larger just beneath the female bracteole. Plants unisexual. Male inflorescence small; male bracts 10 or fewer, quite small, quite concave, 2-lobed for about  $\frac{1}{3}$  the length, the lobes obtuse, spreading. Female bracts much larger than the leaves of sterile stems, appressed to the perianth, 2-lobed for about  $\frac{1}{2}$  the length; the lobes ovate-triangular, obtuse; the sinus acute; bracteole rounded to cuneate, obtuse, concave, widely emarginate to 2-angled at tip. Perianth large, oblong-cylindric, hardly plicate; mouth wide, entire to slightly sinuate, sometimes incisely lobed. Mature sporophyte unknown. The name the *L. exiguus*, slender; in reference to the narrow leafy shoots.—On bark.

ILLUSTRATIONS: None.

EXAMINATIONS: None.

TYPE LOCALITY: Louisiana (Langlois).

RANGE: La. (491). Known only from the type collection.

*CHILOSCYPHUS*<sup>66</sup> Corda, Opiz, Beitr. 651, 1828.

Plants in patches or mats, yellowish green to dark green; leafy shoots 2-6 mm wide. Stems prostrate to erect; branches moderately abundant, irregular, nearly all arising laterally behind the ventral margin of the leaf. Rhizoids in tufts, from the bases of the underleaves, often from

<sup>65</sup> ăx ȳg' ũ ä.  
<sup>66</sup> kī lō sȳ' fūs.

their axils, often with numerous lobate branches at tip. Leaves alternate, dorsally decurrent, distinctly to quite strongly succubous, usually unlobed but occasionally some retuse to emarginate; rounded-quadrate to somewhat rectangular or shortly oblong; margins entire. Cells of the leaf middle 20-54  $\mu$ , of the tips of the leaves 15-40  $\mu$ , the cell-hollow angular; walls thin or little thickened; trigones wanting to small. Gemmae unknown in most of our species. Underleaves present throughout, free in ours,<sup>66a</sup> except connate with one leaf in *C. pallescens*, mostly deeply 2-lobed, mostly with a tooth on one or usually both margins, these teeth when large sometimes make the underleaf appear 4-lobed. Plants unisexual or usually bisexual; with occasional exceptions both inflorescences on short branches. Male branches in bisexual species above or below the female branches, similar to vegetative branches in appearance; male inflorescence not terminal on a branch; male bracts like the leaves of sterile branches, at base with a small sac formed by an antheridial lobule on the base of the dorsal margin; lobule triangular, containing 1-2 antheridia. Female inflorescence constituting a short lateral branch, not an intercalary one; female bracts much smaller than the leaves of sterile shoots, applied to the perianth and sometimes apparently arising above its base, 2-3-lobed; bracteole similar to the bracts in form and size. Perianth cylindric to clavate or obconic to campanulate,  $\frac{3}{4}$ - $\frac{5}{8}$  of it above the tips of the bracts; mouth wide, 3-lobed, the lobes entire to lobed or toothed. Calyptra large, nearly always more or less longly projecting from the perianth, pyriform, delicate. Seta long, in cross section composed of cells all much alike in size. Sporangium ovoid, the wall of 3-4 layers of cells. The name from *Gk. cheilos*, a lip, and *skyphos*, a cup; in reference to the often lipped perianth.

The crucial specific characters are in the reproductive structures and by far the most of the material collected is sterile. As a result keys are somewhat based upon vegetative characters and these are less reliable than the reproductive ones. This has resulted in uncertainty in the distribution as reported. Much of the range seems to be based on conclusions from sterile material.

Since submerged species are found reproducing mostly when the water has subsided, it is likely that they could be cultivated to reproduce sexually. A wide examination of mature sexual material is highly desirable, coordinating them with stem structure. The sporophyte especially, needs comparative study.

Since the characters used in separation are vegetative and thus more variable, a comparison is considered better than a key only.

<sup>66a</sup> The genus is large, mostly tropical, and union of underleaf with leaf is common.



<i>Chiloscyphus</i>	3 <i>fragilis</i>	3a var. <i>sullivantii</i>	2 <i>rivularis</i>	1 <i>polyanthus</i>	4 <i>pallescens</i>	5 <i>gemmiparus</i>
Gemmae abundant, rare, unknown.....	u	u	u	u	u-r	a
Plants unisexual, bisexual.....	b	..	b	b	b	u
Bases of branches bearing small leaves with deep sinus and acute lobes.....	—	—	—	—	+	—
Plants of wet places, or submerged in quiet or running water.....	q	q	r-q	w	w	..
Cells of the leaf tips in $\mu$ .....	25-30	25-30	15-25	15-25	15-40	$\pm 36$
Lobes of mouth of perianth entire, dentate, spinose.....	pd	..	e-d	e-d	pd	..
Underleaves mostly with 2-3 ciliate teeth on each margin.....	—	+	—	—	—	$\pm$

1. *Chiloscyphus polyanthus*<sup>67</sup> (L.) Corda, Opiz, Beitr. 651, 1828.

*Jungermannia polyanthos* L. Sp. Pl., 1131, 1753.

*Marsupella polyanthos* Dum. Comm. Bot. 114, 1822.

*C. rivularis* var. *calcareus*<sup>68</sup> Schiffn., Beih. Bot. Centralb. 29(2) :103, 1912.

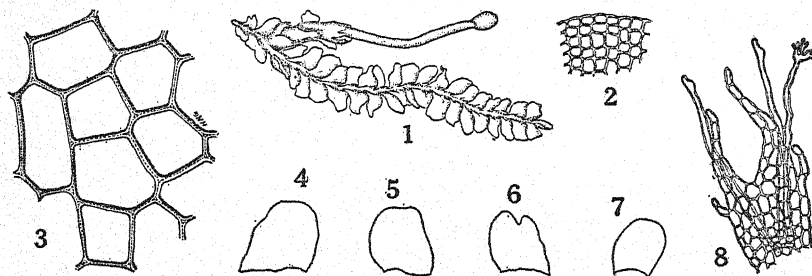
Plants in patches, green to brownish green, drying nearly black; leafy shoots 2-4 mm wide. Stems 2-6 cm long, prostrate to ascending, irregularly branched, dark green; branches several, lateral; in cross section the epidermal cells about 20  $\mu$  wide, the interior 30-35  $\mu$ . Rhizoids rather numerous to nearly obsolete, in tufts from the bases of the underleaves, often terminating in a number of lobe-like branches. Leaves alternate, quite succubous to almost longitudinally inserted, dorsally decurrent, approximate to imbricate, horizontally spreading, unlobed or slightly 2-lobed by an emarginate tip, roundish quadrate to oblong, 0.7-1.6 mm long, 0.54-1.3 mm wide, wider at base than in the middle; apex rounded to emarginate; margin entire. Cells of leaf middle 25-33  $\mu$ , of the tips 15-25  $\mu$ , with angular cell cavity; walls thin; trigones minute or wanting; cuticle smooth or somewhat granulate. Gemmae unknown. Un-

<sup>67</sup>  $\rho\acute{o}\lambda\iota\prime\prime\ \tilde{\gamma}\ \acute{\alpha}\nu\prime\prime\ \theta\acute{\upsilon}\varsigma$ . Corda spelled it *Cheiloscyphos polyanthos*, the Greek form.

<sup>68</sup> Schiffner differentiates this on the following characters: Branches not squarrose, densely leafy. Cells larger than in the usual water forms of *C. rivularis*. Underleaves well developed. Plants bisexual. Male inflorescences on branches near the female branch. Female branch somewhat elongate; female bracts rather large and well developed. Perianth very large; mouth 3-lobed, the lobes not spinose-dentate. Calyptra immersed. Growing on damp calcareous soil.

The only definite characters for this plant are the "somewhat elongate" female branch, the immersed calyptra and the calcareous habitat. We know of no definite observation of the time of emergence of the calyptra. It is probably assumed that it shoves out with the sporangium. It is possible, however, that it elongates even after rupture. The variety seems to us more reasonable as a form.

derleaves present throughout but sometimes hidden by rhizoids, distant, small, recurved, unlobed to mostly 2-lobed, oblong-ovate to lanceolate, small, the margin entire or with a tooth on one or both margins, the lobes subulate, the sinus reaching  $\frac{1}{2}$ – $\frac{3}{4}$  the length. Plants bisexual. Male inflorescence on the stem or on normal long branches, intercalary or terminal; male bracts like the leaves in size and form except for an inflexed lobule at the dorsal base; antheridia 1 or rarely 2, enwrapped by the lobule. Female inflorescence on a very short modified lateral branch; female bracts united at base and with the bracteole and thus forming an involucre, much smaller than the leaves, shortly and unequally 2-lobed



*Chiloscyphus polyanthus*. 1, Plant with sporophyte,  $\times 2.1$ . 2, Cells of leaf margin,  $\times 64$ . 3, Median leaf cells,  $\times 410$ . 4–7, Various forms of leaves,  $\times 4.2$ . 8, Underleaf with rhizoids from base,  $\times 64$ . (3, original by Helen M. Gilkey; the others after K. Mueller.)

to retuse, the lobes obtuse to acute; bracteole small, about the same size as the bracts, 2-lobed. Perianth campanulate or goblet-shaped, 2–2.5 mm long, 0.9–1.5 mm wide, deeply 3-lobed, the lobes obtuse to truncate, the margin most commonly entire but sometimes dentate. Calyptra clavate, emergent for  $\frac{1}{4}$ – $\frac{1}{3}$  its length when mature. Seta 2–3 cm long. Sporangium ovoid, 1.2–1.5 mm long, the wall of 4–5 layers of cells; epidermal cells with nodular or imperfectly semiannular thickenings; innermost layer with semiannular bands. Elaters 120–200  $\mu$  long, 8–11  $\mu$  thick; spirals 2, loosely coiled, reddish brown. Spores 12–20  $\mu$ , finely granulate, yellowish brown. The name from Gk. *polys*, many, and *anthos*, flower, therefore with numerous flowers; probably because its female inflorescences are on short lateral branches and the branches rather numerous.—On wet ground, on wet logs, or among other bryophytes.

ILLUSTRATIONS: K. Mueller (409) 1: figs. 353–354; Pearson (433) 2: pl. 106; Hooker (285) pl. 62; Ekart (124) pl. 6, fig. 50; Macvicar (374) 247, figs. 1–4; Meylan (386) figs. 133A, 134; Warnstorf (523) 1:256, fig. 3; Gil (76) figs. 259–260.

EXAMINATIONS: *Alaska*. Popoff Island (Kincaid) 1898.—*Ida*. Bonners Ferry (Frye) 1928; Cascade (Rakestraw) 1934; Gibbonsville (Frye) 1929.—*Mont.* St. Ignatius (Frye) 1934.—*N.Y.* Panther Mountain in Herkimer County (Haynes) year (?).—*Ore.* La Tourelle (Foster 212) 1904; McKenzie River (Rakestraw) 1935;

Wallowa Lake (Rakestraw) 1935.—*Wash.* Elwha River Valley in Olympic Mts. (Svihla 290) 1931; Olga (Frye) 1904; Mt. Carlton (Bonser) 1909.—*Wyo.* Sheridan County (Rollins 364) 1934; Teton County (Porter 1236) 1932; Thumb (Frye) 1937.

TYPE LOCALITY: European.

RANGE: Labrador (510), Miquelon Isl. (431), N.S. (373), Me. (168), N.H. (359), Vt. (142), Mass. (5), R.I. (140), Conn. (169), N.Y. (104.1), Ont. (373), Pa. (338), Wis. (98), Minn. (408.4), Iowa (469), Wyo. (412), Mont. (81), Alta. (51), Alaska (135), B.C. (373), Ida. (508), Wash. (390), Ore. (84.3), Cal. (296), Mo. (212), Tenn. (12), N.C. (43), W.Va. (3.1), D.C. (343), N.J. (212); Asia (247.08); Africa (460.16); Eur. (329); Azores (56.58); Madeira (56.58); Spitzbergen (460.16); Iceland (350).

2. *Chiloscyphus rivularis*<sup>69</sup> (Schrad.) Loeske, Abh. Bot. Verh. Prov. Brandenburg 172-174, 1904.

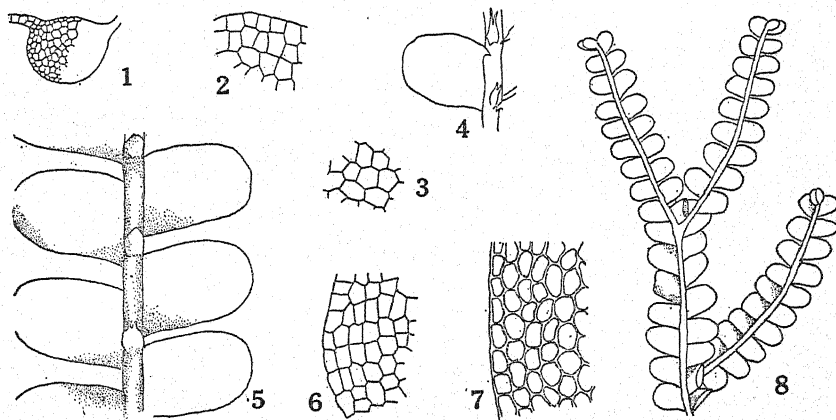
*Jungermannia pallescens* var. *rivularis* Schrad. Syst. Samml. Crypt. Gewächse 2:7, 1797.

*Jungermannia polyanthos* var. *rivularis* Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14, Suppl.: 30, 1829.

*C. polyanthos* var. *rivularis* Nees Naturg. Eur. Leberm. 2:374, 1836.

*C. rivularis* var. *subteres*<sup>70</sup> Schiffn., Beih. Bot. Centralb. 29(2):102, 1912.

Plants in tufts, dark green to blackish green; leafy shoot 2-4 mm wide. Stems 1-10 cm long, decumbent, rigid, branched; branches lateral, numerous, spreading; in cross section the epidermal cells about 20  $\mu$ , the



*Chiloscyphus rivularis*. 1, Cross section of stem, x34. 2, Cells near leaf tip, x111. 3, Median leaf cells, x111. 4, Part of shoot, ventral view, x6.9. 5, Part of shoot, ventral view, x13.2. 6, Cells near leaf tip, x111. 7, Cells along leaf margin, x132. 8, Plant, dorsal view, x3.7. (5, 7-8, after Gil; the others after Schiffner.)

<sup>69</sup> riv ù lã' ris.

<sup>70</sup> This variety is based upon the following characters: Plants blackish green, robust. Branches at a smaller angle than in the type, more bunched. Leaves large, crowded, ascending, thus making the leafy shoots subterete. Cells larger than in the type but smaller than in *C. polyanthos* and *C. pallescens*. Schiffner mentions numerous European localities and one American; the American one is Sisson (now Shasta City), California. Since the habitat is in swiftly flowing water, the direction of the branches and leaves are probably due to the habitat. Since these are the chief characters upon which the variety is based, we consider it a mere form.

interior ones about 25  $\mu$ . Rhizoids few, short. Leaves alternate, quite succubous to nearly longitudinally inserted, dorsally decurrent, distant to approximate or sometimes imbricate, horizontally spreading, unlobed to merely emarginate at tip, oblong-rectangular or orbicular to wider than long, of nearly equal width throughout, apex rounded to emarginate; margin entire. Cells of the leaf middle 20-50  $\mu$ , of the margin 15-25  $\mu$ , opaque; walls thin; trigones wanting. Gemmae unknown. Underleaves wanting or destroyed except on young parts, usually small and tender, the apex not indented to shortly 2-lobed, the lobes subulate to filiform, the margins usually entire. Plants bisexual; sexual reproduction scarce.<sup>71</sup> Male inflorescence along the middle of a short lateral branch; male bracts like the leaves of sterile stems in form and size except for an inflexed antheridial lobule at the base of the dorsal margin; antheridia 1-2. Female inflorescence constituting a slightly elongate lateral branch. Perianth deeply 3-4-lobed, the lobes acute to bluntly rounded, or truncate to shortly and bluntly 2-toothed or 2-lobed, very rarely the teeth sharply pointed. Calyptra in fruit long, emergent for  $\frac{2}{3}$  its length. Seta 15-18 mm long. Sporangium comparatively small. Elaters rather blunt at ends; spirals 2. Spores about 18  $\mu$ , rather smooth. The name the *L. rivularis*, pertaining to a rivulet; in reference to its occurrence submerged in rivulets. —Submerged in pure clean water of lakes or in running water of streamlets, or along the shores of larger streams; rarely just above the water.

ILLUSTRATIONS: Schiffner, Kritische Bemerkungen ueber europäischen Lebermoose, series 6; in Beih. Bot. Centralb. 29: pl. 1, figs. 1-6, 1912; Gil (76) figs. 261-262; Jensen (323.5) 179, 3 figs.; K. Mueller (409) 1: fig. 355; Steere (485.5) pl. 11, figs. 1-2.

EXAMINATIONS: *Alaska*. Copper Center (Thompson) 1933; Egg Harbor (Frye) 1913.—*B.C.* Swanson Bay (Frye) 1913; Yoho National Park (Rakestraw) 1937.—*Cal.* Kelseyville in Lake County (Carter 352) 1933.—*Ida.* Cascade (Frye) 1929; Moscow (Clark 121) 1924.—*Mont.* Glacier National Park (Frye) 1934; Lolo Hot Springs (Frye) 1929.—*Ore.* Government Camp on Mt. Hood (Rakestraw) 1936; Ice Lake in Wallowa Mts. (Rakestraw) 1935.—*Utah.* Bald Mts. (Flowers 2124) 1927.—*Wash.* Aberdeen (Foster) 1909; Friday Harbor (Clark) 1923.—*Wyo.* Dubois (Clayton 690) 1930; Yellowstone National Park (Frye) 1934.

TYPE LOCALITY: European.

RANGE: Newfoundland (168), Anticosti (373), Prince Edward Isl. (373), N.S. (413), N.B. (373), Me. (369.1), N.H. (168), Vt. (169), Mass. (303), R.I. (168), Conn. (169), N.Y. (4), Que. (178), Pa. (168), Mich. (104.01), Wis. (94.1), Wyo. (83), Mont. (328), Alaska (173), B.C. (168), Ida. (81), Wash. (218.1), Ore. (457), Cal. (84.1), Utah (214.1), Colo. (175), N.Mex. (496), Tex. (168), Okla. (354), N.C. (43), W.Va. (3.2), Va. (271), Md. (444); Asia (308.1); Eur. (2.02).

<sup>71</sup> Sexual reproduction apparently does not occur in submerged plants.



3. *Chiloscyphus fragilis*<sup>72</sup> (Roth.) Schiffn. Kritische Bemerkungen ueber europäischen Lebermoose, series 6; in Lotos 58, 1910.

*Jungermannia fragilis* Roth Fl. Germ. 3:370, 1803.

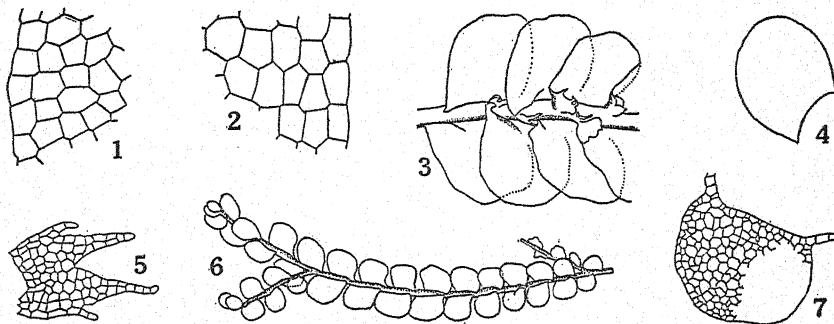
*C. polyanthus* var. *erectus* Schiffn., Lotos 48:332, 1900.

*C. polyanthus* var. *fragilis* K. Muell., Rabenh. Krypt.-Fl. 6(1):823, 1911.

*C. fragilis* var. *calcareus*<sup>73</sup> Schiffn., Beih. Bot. Centralb. 29(2):96, 1912.

*C. polyanthus* var. *inundatus* Famillar, Fl. Bavaria, Exsic. No. 605, according to Schiffner (460.16).

Plants quite large, in tufts, usually dark green, sometimes yellowish green; leafy shoots 3-5 mm wide. Stems prostrate or ascending, thick, twice as thick as in *C. rivularis*, rather flaccid, elongate, slightly branched, dark green; epidermal cells about 20  $\mu$ , interior cells 35 by 60  $\mu$ . Rhizoids few, from the axils of the underleaves. Leaves hardly to long decurrent, distant to imbricate, horizontally spreading to dorsally ascending, unlobed or with a suggestion of bilobing, broadly oblong-quadrate to roundish-quadrate, 2-3 mm wide, often wider than long, rarely small, flaccid, dis-



*Chiloscyphus fragilis*. 1-2, Cells of the leaf tip,  $\times 111$ . 3, Male branch, dorsal view,  $\times 8$ . 4, Leaf,  $\times$  about 3.5. 5, Underleaf,  $\times 32$ . 6, Plant, dorsal view,  $\times 1.1$ . 7, Cross section of stem,  $\times 32$ . (4, 6, after K. Mueller; the others after Schiffner.)

tinctly convex dorsally; apex rounded or rarely emarginate. Cells of the leaf middle 30-50  $\mu$ , of the apex 25-30  $\mu$ , chlorophyllose, slightly translucent; walls thin; trigones wanting or very minute. Gemmae unknown. Underleaves free, small, often wanting through decomposition, 2-lobed for  $\frac{3}{5}$  or more, the margin sometimes ciliate or dentate. Plants bisexual; both inflorescences on short lateral branches. Male branches near the female ones; male inflorescence hardly terminal, constituting most of the branch, not spicate; male bracts with antheridial lobule at dorsal base; lobules variable, from toothed to somewhat ciliate; antheridium 1. Female inflorescence constituting the whole of the female branch. Mouth of perianth deeply 3-lobed, the lobes dentate with spinose-ciliate teeth. Calyptra

<sup>72</sup> fräj' i līs.

<sup>73</sup> Evans (168) refers to this a collection from Tate Mine, Marydale, Utah.

long emergent, 2-3 cells thick. Sporangial epidermal cells with semi-annular thickenings or smooth. Elaters about  $9\ \mu$  thick; spirals 2. Spores about  $18\ \mu$ , yellowish brown. The name the *L. fragilis*, delicate or brittle; the reason is not clear to us.—In stagnant water of springs or wet grassy places, not in flowing streams.

ILLUSTRATIONS: Schiffner, Beih. Bot. Centralb. 29(2): pl. 1, figs. 7-11, 1912; Jensen (323.5) 187, 2 figs.; K. Mueller (409) 1: fig. 356; Steere (485.5) pl. 11, figs. 3-4; Macvicar (374) 247, fig. 5.

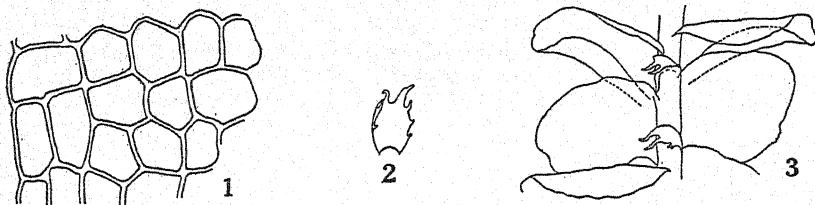
EXAMINATIONS: B.C. Union Bay (Frye) 1923.—Cal. Smith River (Rakestraw) 1936; Weitchpec (Frye) 1933.—Colo. Ophir Creek in Greenhorn Mts. (Rakestraw) 1938.—Ida. Cape Horn (Frye) 1929; Knox (Frye) 1929.—Mich. Cheyboygan (Woollett) 1923.—Mont. Connors (Frye) 1929; Many Glaciers (Frye) 1928.—Ore. McKenzie River (Rakestraw) 1936; Prairie City (Frye) 1932.—Wash. Friday Harbor (J. E. Kirkwood) 1926; Stevens Pass (Frye) 1929.—Wyo. Leigh Lake in Teton County (Porter 1184) 1932; Yellowstone National Park (Frye) 1934.

TYPE LOCALITY: European.

RANGE: Newfoundland (168), N.S. (41.3), N.B. (369), Me. (500.1), N.H. (168), Mass. (460.16), Conn. (169), N.Y. (58), Que. (178), Pa. (237), Mich. (419.2), Wis. (98), Wyo. (445), Mont. (81), Alta. (51), Ida. (84), B.C. (46.1), Wash. (81), Ore. (51.1), Cal. (84.1), Utah (338), Colo., Tenn. (464), N.C. (43), W.Va. (3.2); Eur. (460.16); Iceland (460.16).

3a. *Chiloscyphus fragilis* var. *sullivantii*<sup>74</sup> Schiffn., Beih. Bot. Centralb. 29(2): 95, 1912.

Plants in tufts, dull green, similar to *C. fragilis* in size and general appearance; leafy shoots 3-5 mm wide. Stems fleshy. Rhizoids few. Leaves alternate, quite succubous, hardly or not at all decurrent, contiguous or slightly imbricate, horizontally spreading, unlobed or with a suggestion of bilobing, ovate-rectangular, usually strongly concave to semicylindric dorsally through the recurving of the margins; margins entire; apex rounded



*Chiloscyphus fragilis* var. *sullivantii*. 1, Cells of the leaf tip,  $\times 222$ . 2, Underleaf,  $\times 8$ . 3, Small part of plant, ventral view,  $\times 8$ . (All after Schiffner.)

to emarginate. Cells of the leaves about  $30\ \mu$ , with roundish to angular cell cavity, marginal cells narrower and longer; walls somewhat thickened; trigones minute. Gemmae unknown. Underleaves each directly adjacent to the ventral base of a leaf but not united with it, mostly large, narrower

<sup>74</sup>sui li vãn' ti i.

than the stem, recurved-squarrose, 2-lobed for about  $\frac{1}{3}$  their length, each margin 0-3-ciliate; the lobes spreading, ending in long cilia; the sinus obtuse to roundish. Named in honor of W. S. Sullivant, in whose exsiccati it was first distributed.—On rocks along mountain rivulets.

ILLUSTRATIONS: Schiffner, Beih. Bot. Centralb. 29(2): pl. 1, figs. 12-14, 1912.

EXAMINATIONS: None.

TYPE LOCALITY: Magnolia, Massachusetts (W. G. Farlow) July, 1903; distributed as Sullivant's Musci Alleghenienses Exsic. No. 248. Magnolia is about Lat. 42° 34' N., Long. 70° 43' W.

RANGE: Mass. (460.16), Conn. (168).

4. *Chiloscyphus pallescens*<sup>75</sup> (Ehrh.) Dum. Syll. Jung. Eur. 67, 1831.

*Jungermannia viticulosa* L. Sp. Pl. 1597, 1753, in part.

*Jungermannia pallescens* Ehrh. Deutsch. Fl. 2:87, 1795.

*Jungermannia polyanthos* var. *pallescens* Lindb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14, Suppl.:30, 1829.

*C. lophocoleoides* Nees Naturg. Eur. Leberm. 2:365, 1836.

*Jungermannia ascendens*<sup>76</sup> Hook. & Wils. in Drumm. Musci Amer., Exsic. No. 165, 1841.

*C. ascendens* Sull. Musci Alleghanienses 58, 1845.

*C. labiatus* Tayl., London Jour. Bot. 5:284, 1846.

*C. polyanthos* var. *pallescens* Hartm. Skand. Fl., Ed. 10, 145, 1871.

*C. viticulosus* Lindb., Acta Soc. Sci. Fennica 10:505, 1875.

*C. polyanthus* var. *grandicalyx* Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):24, 1889.

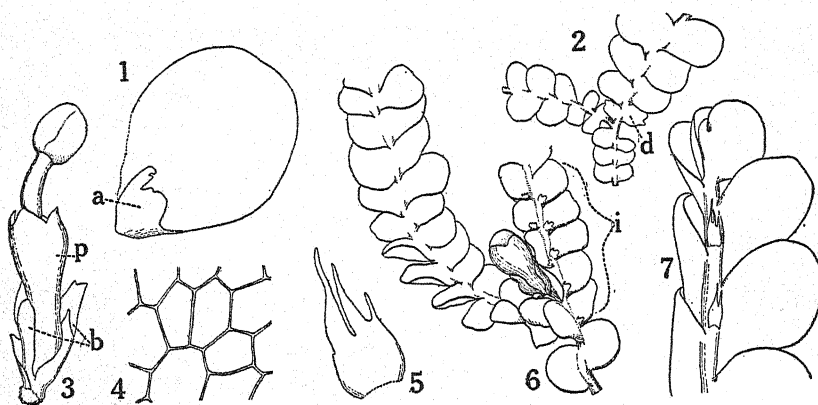
*C. webberianus*<sup>77</sup> Steph., Bull. Herb. Boissier, Ser. 2, 8:143, 1908; also Sp. Hep. 3:259, 1908.

Plants in thin patches, pale green to pale yellowish green; leafy shoots 2-3.5 mm wide. Stems 1-3 cm long, prostrate or ascending, branches few to many. Rhizoids common, in tufts at the bases of the underleaves, colorless. Leaves alternate, quite succubous, dorsally decurrent, imbricate, ascending, horizontal, unlobed to 2-lobed, oblong-quadrate to roundish-quadrate, about 2 mm long, 1-1.5 mm wide, often distinctly dorsally concave, apex rounded or usually truncate to retuse; margins entire, occasionally quite convex; lobes acute to rounded, or in occasional leaves acute to obtuse; sinus from wanting to  $\frac{1}{3}$  the leaf length, mostly roundish to crescentic, acute in occasional leaves; small leaves at base of branch 2-lobed for  $\frac{1}{4}$ - $\frac{1}{3}$  the length, the lobes acute, the sinus acute to rounded. Cells of the leaf middle 30-50  $\mu$ , near the tip 20-40  $\mu$ , near the base sometimes up to 40 by 65  $\mu$ , mostly 6-angled, rather translucent, the chloroplasts golden yellow; walls thin; trigones minute. Gemmae known to occur on the male and female bracts and on the lobes of the perianth,

<sup>75</sup> päl lēs' sēns.

<sup>76</sup> Most authors spell this *adscendens*. We are unable to check with the original spelling.

<sup>77</sup> Evans, Bryologist 27:50, 1924, says he has examined some of the type material and found it to be *C. pallescens*. Stephani describes the plant as bisexual, which therefore seems to have been an error.



*Chiloscyphus pallescens*. 1, Male bract showing antheridial lobule (*a*),  $\times 18$ . 2, Dorsal view of branches showing leaf distinctly lobed (*d*) just above the fork,  $\times 4$ . 3, Female bracts (*b*), perianth (*p*), and sporophyte,  $\times 8$ . 4, Cells of the leaf middle,  $\times 192$ . 5, Underleaf,  $\times 58$ . 6, Part of plant, ventral view, showing male inflorescence (*i*),  $\times 4$ . 7, Tip of shoot, showing underleaves,  $\times 11$ . (All original, by Elizabeth Curtis.)

some of them united into irregular groups. Underleaves large, spreading, 2-lobed, ovate-oblong; the lobes subulate, often with a tooth or cilium on the outer margin; the sinus descending  $\frac{1}{2}$ – $\frac{3}{4}$  the length of the underleaf, acute, narrow. Plants bisexual. Male inflorescence about the middle of a branch or shoot arising below the female inflorescence; male bracts 6-12, resembling the leaves but with a small inflexed antheridial lobule at the base of the dorsal margin; the lobule saccate, quadrate, 2-toothed; antheridia 1 or rarely 2. Female inflorescence on a very short lateral branch; female bracts much smaller than the leaves of sterile shoots, shortly 2-lobed, the lobes acute to obtuse; bracteole small, 2-lobed, its lobes ciliate to ciliate-dentate. Perianth widely tubular when immature, in maturity a narrow inverted cone, often subtended by innovations which in turn bear female inflorescences; mouth the widest part of the perianth, deeply 2-4-lobed, the lobes coarsely spinose-dentate or lacerate. Calyptra from half as long as the perianth to  $\frac{1}{5}$  emergent. Sporangium ovoid, reddish brown, 4-valved to base, the wall 4-5 cells thick. Elaters 8-10  $\mu$  thick; spirals 2, reddish brown. Spores 12-18  $\mu$ , finely granulate, yellowish brown to reddish brown. The name the *L. pallescens*, becoming pale; in reference to the pale green color.—On wet ground, on rotting logs, on mosses.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 357; Sullivant (498) pl. 7; Ammons (3.1) 139, fig. B; Macvicar (374) 249, figs. 1-3; Steere (485.5) 60, figs. 1-2; Jensen (323.5) 187, 1 fig.

EXAMINATIONS: *Alaska*. Aats Bay (Frye) 1913.—*Alta*. Waterton Park (Rakestraw) 1937.—*Cal.* Crescent City (DuVall) 1935; Smith River (Rakestraw) 1935. *Colo.* Green Mt. (Ranny) 1939.—*Ida.* Gibbonsville (Frye) 1929; Moscow (Clarke) 1923.—*Mont.* Glacier National Park (Frye) 1934; Polson (Frye) 1928.—*N.C.* Dur-



ham (Blomquist 7188) 1935.—*Ore. Cornucopia* (Forbes) 1935; Port Orford (Frye) 1932.—*S.D. Lead* (Frye) 1935.—*Wash. Kalama River* (Rakestraw) 1934; Snoqualmie (Bailey) 1930.

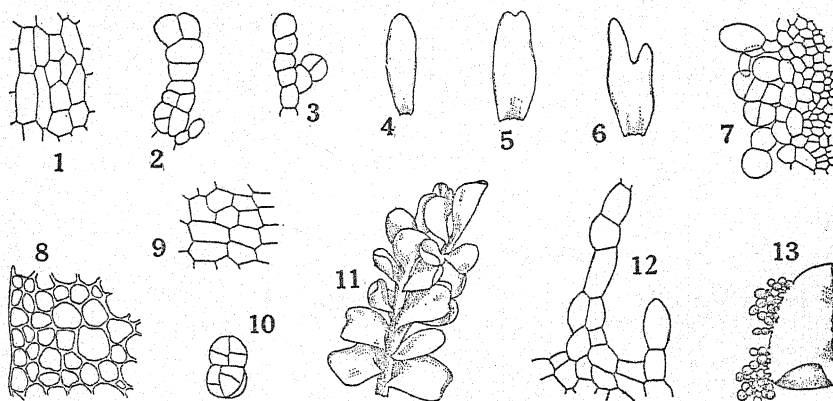
TYPE LOCALITY: European.

RANGE: N.S. (413), Me. (145), N.H. (142), Vt. (176), Mass. (232), R.I. (169), Conn. (140), N.Y. (59), Que. (3.1), Pa. (226), Ont. (373), Ohio (460.16), Ind. (427), Mich. (213), Ill. (246.5), Wis. (98), Minn. (94.1), S.D., Mont., Alta. (46.2), Alaska (173), B.C. (373), Ida. (80.1), Wash. (81), Ore. (437), Cal. (202), N. Mex. (3.1), Utah (214.1), Colo., Nebr. (204), Mo. (168), Tenn. (464), N.C. (43), Ky. (3.1), W.Va. (3.2); Java (226); Asia (350); Eur. (325).

Schiffner finds the male bracts are similar to the leaves of sterile stems except that they have the antheridial lobule as in other species of *Chiloscyphus*. The report that the male inflorescences are spicate branches of almost bud-like size was the chief reason for its separation, and were it so, would put the species in the genus *Heteroscyphus*. We are following Evans (142) in considering *C. ascendens* a synonym of *C. pallescens*.

##### 5. *Chiloscyphus gemmiparus*<sup>78</sup> Evans, Bryologist 41:50, 1938.

Plants in compact tufts, yellowish brown; leafy shoots 5-6 mm wide. Stems erect or ascending, mostly 300-500  $\mu$  wide and 200-350  $\mu$  thick; branches few, at an acute angle, replacing the ventral half of the leaf, or occasional branches intercalary and ventral to the leaf axil: in cross section of stem the epidermal cells mostly smaller than the interior ones, averaging 17 x 14  $\mu$ , their radial walls thinner than the walls of the interior ones; the interior cells mostly 20-30  $\mu$ , their walls distinctly thickened: epidermal cells in surface view 1-3 times as long as wide; in longi-



*Chiloscyphus gemmiparus*. 1, Epidermal cells of stem, surface view, x 119. 2-3, Gemmiparous leaf filaments, x 119. 4-6, Large underleaves, x 9. 7, Tip of young gemmiparous leaf, x 119. 8, Part of cross section of stem, x 119. 9, Median leaf cells, x 119. 10, Gemma, x 119. 11, Tip of plant, dorsal view, x 3.2. 12, Normal underleaf, x 119. 13, Tip of gemmiparous leaf, x 26. (All after Evans.)

<sup>78</sup> jēm mī' pā rūs.

tudinal section of stem the interior cells 2-4 times as long as wide. Leaves alternate, distinctly succubous, imbricate, erect-spreading to spreading, somewhat horizontal, rounded to retuse but not more deeply lobed, oblong from a wide base, 1.2-2 mm long, 1.2-1.6 mm wide, usually somewhat concave; margin entire. Cells of the leaf middle about 18-25  $\mu$ , of the margin scarcely smaller, of the base about 25  $\mu$  wide and 40-80  $\mu$  long; walls thin; trigones wanting to minute. Gemmae abundant, in simple or branched filamentous clusters from the apical margins of the upper leaves, composed of 1 to several cells, spherical to ellipsoid, thin walled, smooth, walls not pigmented. Underleaves fairly large to usually small, free, irregular, sometimes hard to find, some of them a mere base a few cells high with processes composed each of a row of cells and ending in a slime cell, some of them with a few processes at base and a blade-like extension, rarely the blade-like extension 2-lobed, the largest about 1.8 mm long and 650  $\mu$  wide. Sexual reproduction and sporophyte unknown. So named on account of the abundant gemmae.—In wet habitat or possibly submerged.

ILLUSTRATIONS: Evans, Bryologist 41:52, figs. 1-18, 1938.

EXAMINATIONS: None.

TYPE LOCALITY: Spirit Lake, near timber line, Uinta Mountains, Ashley National Forest (Svihla 476), August 18, 1928.

RANGE: Utah (211.5). Known only from the type collection.

LOPHOCOLEA<sup>79</sup> Dum. Rec. d'Obs. 17, 1835.

*Jungermannia* section *Lophocolea* Dum. Syll. Jung. Eur. 59, 1831.

Plants soft, flaccid, green to whitish green or yellowish green. Stem creeping, irregularly branched; branches originating between the leaf axil and the underleaf. Rhizoids colorless, in tufts, sometimes from the axils of the underleaves. Leaves alternate to opposite, strongly succubous, more or less dorsally decurrent, truncate to usually simply 2-lobed; margins usually entire or occasionally ciliate or spinose especially near the female bracts; lobes rounded to usually long acuminate or ending in a single row of cells; sinus descending  $\frac{1}{3}$  the leaf length or less. Cells of the leaves polygonal, thin walled; trigones wanting to small. Gemmae 1-celled, in nearly all species scarce. Underleaves present throughout, free, or connate with 1 or 2 leaves, erect-spreading, comparatively large but much smaller than the leaves, from  $\frac{1}{4}$  to nearly as long as the leaves but distinctly narrower, 2-lobed, usually with a tooth or lobe on each margin, but the margins varying from rarely entire to rarely 2-toothed or 2-lobed, thus the underleaves may be 4-lobed; the 2 chief lobes narrowly lanceolate to subulate, from acuminate to ending in a single row of cells. Plants

<sup>79</sup> 16' f6 k8' 18' a.

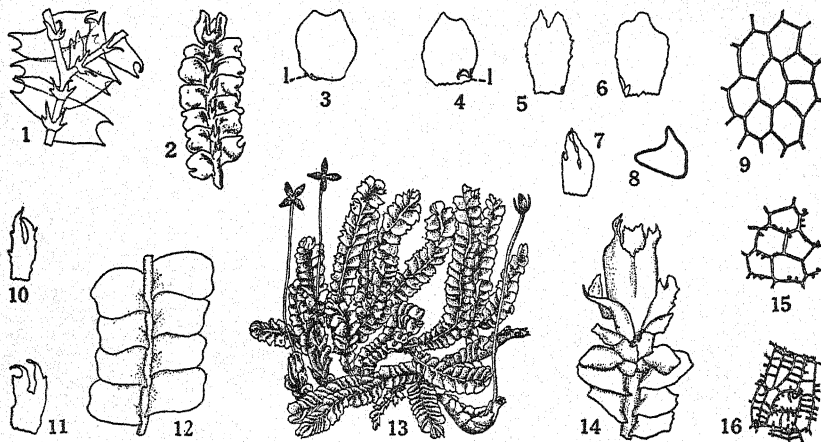
unisexual or bisexual. Male inflorescence terminal or farther down the stem or branch, long-spicate; male bracts with an inflated dorsal lobule; antheridia 1 per bract. Female inflorescence terminal on main stem or normal well developed lateral branch; female bracts much like the leaves of sterile stems, slightly larger, inclined to be more dentate or ciliate; bracteole quite large. Perianth prismatic, 3-angled, 2-3 times as long as wide, often the keels winged; mouth wide, 3-lobed; the lobes usually with 2 smaller lobes, denticulate or ciliate. Calyptra free. Seta in cross section composed throughout of similar cells, the epidermal ones with thicker walls. Sporangium ovoid, the wall of 4-5 layers of cells; epidermal cells very large, as thick as the other 3-4 layers combined, with nodular thickenings; innermost layer of cells with semiannular thickenings. Spores mostly smooth, about twice the diameter of the elaters. The name from Gk. *lophos*, crest, and *koleos*, sheath; in reference to the crested or toothed ridges of the perianth in some species.

- A. Terminal dozen or fewer leaves at tip of the sterile stems rounded to merely emarginate; male inflorescence just below the female on the same shoot, or rarely farther down; leaves distinctly alternate; underleaves free..... 1. *L. heterophylla*.
- AA. Terminal as well as other leaves more deeply notched, 2-toothed to more toothed or lobed, the lobes sharply pointed unless eroded through the formation of gemmae; male inflorescence nearly always on a separate shoot or plant from the female; leaves opposite or alternate; underleaves free or connate with 1 or 2 leaves.
- B. Leaves of sterile stems distinctly alternate; most of the underleaves free from the leaves.
- C. Cells of the leaf middle 25-30  $\mu$ ; plants unisexual, or rarely in *L. minor* the male bracts below the female ones on the same stem; underleaves free from the leaves.
- D. Female inflorescence rare; some of the angles of the perianth moderately winged; gemmae unknown; even the upper leaves with sharply pointed lobes..... 2. *L. bidentata*.
- DD. Female inflorescence common; none of the angles of the perianth winged; gemmae nearly always present; some of the upper leaves so erose from the formation of gemmae that their lobes are rounded to wanting... 3. *L. minor*.
- CC. Cells of the leaf middle 30-50  $\mu$ ; plants bisexual, the male inflorescence on separate shoots; underleaves free from the leaves, or in *L. cuspidata* sometimes connate with one leaf.
- E. Plants whitish green or yellowish green; wings of the angles of the perianth from wanting to 3 cells high, entire at margin; all or most of the underleaves free from the leaves..... 4. *L. cuspidata*.
- EE. Plants dark green; wings of the angles of the perianth 3-9 cells high, the highest ones spinose-dentate; all underleaves free from the leaves..... 5. *L. alata*.
- BB. Leaves of sterile stems opposite or nearly so; underleaves nearly all connate with 1 or 2 leaves; plants bisexual, the male inflorescence on separate shoots.
- F. Cells of the leaf middle 30-40  $\mu$ , without cellular projections; underleaves with sinus  $\frac{2}{5}$ - $\frac{3}{5}$  their length..... 6. *L. martiana*.
- FF. Cells of the leaf middle, 18-20  $\mu$ , dorsally muriculate with projections 2-3 cells long; underleaves with sinus about  $\frac{1}{2}$  their length..... 7. *L. muricata*.



1. *Lophocolea heterophylla*<sup>80</sup> (Schrad.) Dum. Rec. d'Obs. 15, 1835.*Jungermannia heterophylla* Schrad., Jour. für die Bot. 5:66, 1801.*L. macounii* Aust., Proc. Philadelphia Acad. Sci. 21 (1869): 223, 1870.*L. minor* of Aust. Hep. Bor. Amer. Exsic. No. 65b, 1873. Not of Nees Naturg. Eur. Leberm. 2:330, 1836.*L. austini* Lindb., Acta Soc. Sci. Fennica 10:503, 1875.

Plants in patches or mats, pale yellowish green; leafy shoots 1-2 mm wide. Stems 2 cm long, prostrate, 150-270  $\mu$  thick, irregularly branched; branches lateral or rarely ventral, moderately common, sometimes with deeply and acutely 2-lobed leaves. Rhizoids numerous, in tufts. Leaves alternate, quite strongly succubous, the insertion extending about half around the stem, dorsally decurrent, distant to approximate, spreading horizontally, simply 2-lobed to quite unlobed and rounded at apex, rarely all the leaves on a plant bilobed, oblong-quadrate, 1-1.3 mm long, 0.6-1 mm wide, convex; margin entire; lobes rounded to acute; sinus from wanting to  $\frac{1}{5}$  the leaf length, crescentic to right-angular. Cells of the leaf middle 20-48  $\mu$ , of the lobes about 20  $\mu$ ; walls thin; trigones wanting to minute; cuticle smooth or occasionally striate. Gemmae unknown. Underleaves comparatively large, erect to erect-spreading, about  $\frac{1}{3}$  as



*Lophocolea heterophylla*. 1, Part of branching shoot, ventral view,  $\times 11.4$ . 2, Sterile shoot, ventral view,  $\times 6.4$ . 3-4, Male bracts, lobule (*l*) at base of dorsal margin,  $\times$  about 13. 5-6, Female bracts, with lobule at base of dorsal margin,  $\times$  about 13. 7, Female bracteole,  $\times$  about 13. 8, Cross section of perianth,  $\times$  about 9. 9, Cells of leaf middle,  $\times$  about 275. 10-11, Male bracteoles,  $\times$  about 13. 12, Part of shoot, dorsal view,  $\times 12.7$ . 13, Plant,  $\times 2.1$ . 14, Tip of plant with perianth, dorsal view,  $\times$  about 6. 15, Epidermal cells of sporangium,  $\times$  about 275. 16, Cells of innermost layer of wall of sporangium,  $\times$  about 275. (1, 3-11, 14-16, after Evans; 2, after Steere; 12-13, after K. Mueller.)

<sup>80</sup> hēt' ēr ō fil' lā.



long as the leaves, 2-lobed for  $\frac{1}{2}$ - $\frac{3}{4}$  length, with an additional tooth on each margin; the lobes subulate, acuminate, curved toward the stem. Plants bisexual. Male inflorescence immediately below the female bracts, or the upper ones functioning as the female bracts, or farther down, or on a separate branch below the female inflorescence, larger to smaller than the leaves of sterile plants depending upon the position, 6-10 in number, very like the leaves in form but with an inflated lobule on the base of the dorsal margin, the lobule with 1-2 teeth at margin; antheridia 1 or rarely 2, about  $140\ \mu$  thick. Female inflorescence on rather short lateral or sometimes ventral branches; female bracts slightly larger than the leaves, erect, cuneate or oblong-quadrate, retuse to shortly and irregularly 2-4-lobed; bracteole almost as large as the bracts, deeply 2-lobed; the lobes lanceolate, the outer margins with 1-3 cilia or teeth. Perianth oblong, 1.3-3.2 mm long, 0.6-1.3 mm wide, sharply 3-angled to base, long exserted; mouth laterally flattened, 3-lobed for  $\frac{1}{6}$ - $\frac{1}{3}$  the length of the perianth; the lobes subtruncate to rarely acute, repand-dentate. Seta 1.5-2 cm long, rather deeply shoved into the tip of the stem. Sporangium ovoid, about 1.2 mm long, 0.7-1 mm thick, reddish brown. Elaters 110-210  $\mu$  long, 8-11  $\mu$  thick; spirals 2, reddish brown. Spores 8-16  $\mu$ , minutely punctate, yellowish brown. The name from Gk. *heteros*, different, and *phyllon*, a leaf; in reference to the presence, commonly, of unlobed leaves near the tip of a stem while farther down they are 2-lobed.—On rotten wood and on trunks of trees, on sod and rocks; in wet situations.

ILLUSTRATIONS: Evans, *Plant World* 1: pl. 6, 1897; Pearson (433) 2: pl. 103; Hooker (285) pl. 31; K. Mueller (409) 1: figs. 349-350; Ekart (124) pl. 7, fig. 54; Macvicar (374) 244, figs. 1-4; Steere (485.5) 60, figs. 4-6; Gil (76) fig. 258; Meylan (386) fig. 132; Ammons (3.1) 138, fig. C; Sullivan (498) pl. 7; Underwood (506) pl. 23; Jensen (323.5) 187, 5 figs.

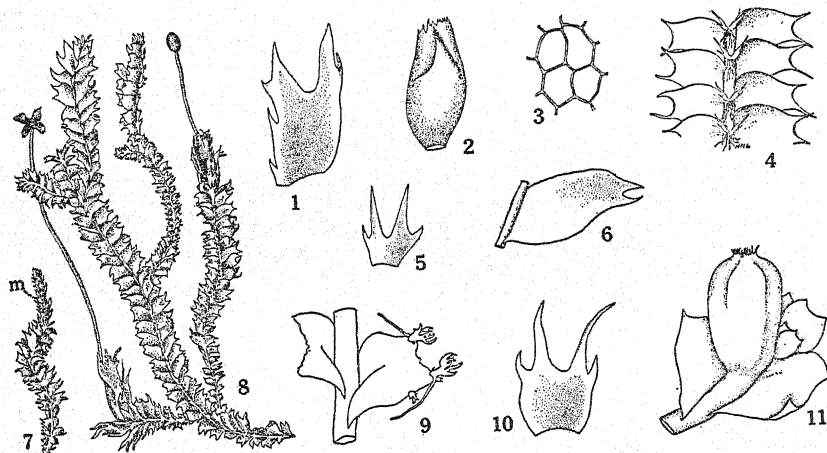
EXAMINATIONS: *Cal.* Cataract Gulch in Marin County (Carter 440) year (?). —*Ill.* Urbana (Drexler 766, 824) 1936.—*Ind.* The Shades in Montgomery County (Drexler 1232) 1917.—*Minn.* Big Thunder Lake in Cass County (Richards 1116) 1940.—*Mo.* Columbia (Drew B377) 1937.—*Mont.* Henderson (Frye) 1925.—*N.J.* Highlands in Monmouth County (Haynes) 1908.—*N.Y.* Little Moose Lake in Herkimer County (Haynes 1035) 1906.—*N.C.* Durham (Blomquist 8738) 1937.—*Ore.* Mt. Hood (Frye) 1933.—*Pa.* Athens (Barbour 26) 1900.—*Tenn.* Reelfoot Lake (Drexler 1388, 1391, 1393-1394) 1938.—*Wash.* Glacier in Whatcom County (Svihla 413) 1932.—*Wyo.* Jenny Lake in Teton County (Porter 228) 1932.

TYPE LOCALITY: European.

RANGE: Miquelon Isl. (431), Prince Edward Isl. (373), N.S. (53.2), N.B. (369), Me. (169), N.H. (359), Vt. (169), Mass. (5), R.I. (169), Conn. (212), N.Y. (58), Pa. (337.09), Ont. (373), Ind. (428.6), Mich. (485.5), Ill. (246.5), Mo. (117.97), Iowa (89), Wis. (94.1), Minn. (94.1), Nebr. (204), Wyo. (445), Mont. (81), Ida. (80.1), B.C. (373), Wash. (81), Ore. (178), Cal. (296), Okla. (353), Mo., La. (499.5), Fla. (237), Ga. (52), N.C. (12), Tenn. (12), Ky. (218.2), W.Va. (3.1), Va. (271), Md. (444), D.C. (282), N.J.; Juan Fernandez Isl. (398); Asia (350); Eur. (409); Canary Isls. (15.1); Azores (2.075).

2. *Lophocolea bidentata*<sup>81</sup> (L.) Dum. Rec. d'Obs. 17, 1835.*Jungermannia bidentata* L. Sp. Pl. 1132, 1753.*Jungermannia bidentata* var. *obtusata* Hook. Brit. Jung., pl. 30, 1816.*Jungermannia bidentata* var. *rivularis* Raddi, Mem. Soc. Ital. Sci. Modena 18:37, 1818.*Jungermannia bidentata* var. *attenuata* Hueben. Hep. Germ. 145, 1834.*L. latifolia* Nees Naturg. Eur. Leberm. 2:334, 1836.*L. hookeriana* Nees Naturg. Eur. Leberm. 2:336, 1836.*L. lateralis* Dum. Hep. Eur. 84, 1874.*L. bidentata* var. *obtusata* Dum. Hep. Eur. 84, 1874.*L. bidentata* var. *rivularis* Warnst. Krypt.-Fl. Mark Brandenburg 1:243, 1902.

Plants in loose patches or scattered singly among other bryophytes, pale green or whitish green; leafy shoots 2.5-3 mm wide, quite flattish. Stems 2-5 cm long, prostrate to ascending, lateral branches rather sparse but ventral branches sometimes numerous, usually rejuvenating below the female inflorescence; in cross section flattish on dorsal side, roundish on the ventral side, interior cells large and thin walled, epidermal cells smaller with thicker walls. Rhizoids scarce, almost wanting, from the bases of the underleaves. Leaves alternate, quite succubous, longly decurrent dorsally, subimbricate, spreading, simply 2-lobed, rhomboid-ovate, widest in the lower third, about as wide as long, unsymmetric, embracing about  $\frac{1}{3}$  of the stem; margins entire except for the apical lobes, the dorsal margin slightly curved, the ventral more curved but rather shorter; lobes often unequal with the ventral lobe the larger, lanceolate



*Lophocolea bidentata*. 1, Large leaf just below female bract,  $\times 12.4$ . 2, Perianth,  $\times 6.8$ . 3, Cells of the leaf,  $\times 117$ . 4, Part of shoot, ventral view,  $\times 3.3$ . 5, Underleaf,  $\times 20$ . 6, Leaf,  $\times 6$ . 7, Part of plant with male (m) inflorescence,  $\times 1.7$ . 8, Plant with two sporophytes,  $\times 1.7$ . 9, Part of plant with new plants arising from leaf,  $\times 6.4$ . 10, Underleaf,  $\times 12.4$ . 11, Perianth,  $\times$  about 7. (3, after Ammons; 6-9, after K. Mueller; 1-2, 5, 10, after Pearson; 11, after Hooker; 4, original by Helen M. Gilkey.)

<sup>81</sup> bī dēn tā' tā.

to subulate, acuminate, often somewhat divergent; sinus descending  $\frac{1}{5}$ - $\frac{1}{3}$  the leaf length, rounded to crescentic. Cells of the leaf middle 28-30  $\mu$ , of the lobes and margin 25-28  $\mu$ , of the base 30-35  $\mu$ , polygonal; walls thin; trigones none or minute; oil bodies small, round; cuticle smooth. Underleaves much smaller than the leaves, spreading, 2-lobed for  $\frac{1}{2}$ - $\frac{3}{4}$  the length, with a long tooth on one or both margins; lobes subulate, acuminate; the teeth shorter than the lobes, likewise subulate and acuminate. Plants unisexual. Male plants often in separate tufts, more tenuous; male inflorescence terminal on a main stem or a branch, or farther down, spicate; male bracts several pairs, much smaller than the leaves, closely imbricate, 2-3-lobed, saccate at base of dorsal margin by a small incurved and dentate lobe; apical lobes unequal, acute, the dorsal one the smaller. Female inflorescence terminal on the main stem or on a lateral branch; female bracts larger than the leaves, oblong-oval to rectangular, 2-lobed for  $\frac{1}{5}$ - $\frac{1}{4}$  the length, symmetric; each margin at least of the upper leaves recurved and entire or with a tooth; the lobes lanceolate, acuminate; the sinus acute to obtuse; bracteole free, oblong-ligulate, 2-lobed for about  $\frac{1}{3}$  the length, one or both margins with a tooth, its lobes lanceolate and acuminate. Perianth rarely found, oblong, 3-angled or 3-winged in the apical half, about  $\frac{1}{2}$ -emergent; mouth deeply 3-lobed, the lobes broadly triangular and acuminate, the margins coarsely dentate with few teeth. Sporangium ovoid to oblong-ovoid, dark brown, the wall of 3-5 layers of cells; epidermal cells large, quadrate, with reddish brown nodular thickenings; innermost layer of cells much smaller, elongate, with numerous annular thickenings. Elaters 8-10  $\mu$  thick; spirals 2, reddish brown. Spores 12-18  $\mu$ , almost smooth, brown. The name the *L. bidentatus*, 2-toothed; in reference to the two teeth on the bilobed underleaves or perhaps the leaves.—On wet submerged rocks, on wet or grassy banks and soil, on rotten wood, or among other bryophytes.

ILLUSTRATIONS: Pearson (433) pl. 101; Hooker (285) pl. 30; Warnstorf (523) 1:245, fig. 4, a-d, e-g; Macvicar (374) 240, figs. 1-4; K. Mueller (409) 1; figs. 346 A, 347; Gil (76) figs. 255-256; Meylan (386) fig. 130; Sowerby, English Bot., pl. 606; Ekart (124) pl. 7, fig. 53; Leitgeb, Lebermoose 2: pl. 6, figs. 1-14, 22, 1875; Ammons (3.1) 138, fig. A.

EXAMINATIONS: B.C. Saturne Island (Frye) 1905.—*Ida*. Moscow Mt. (Clark) 1923.—*Ind.* Turkey Run State Park (Drexler 1424) 1938.—*Ore.* Port Orford (Rakestraw) 1935; Wolf Creek (Frye) 1904.—*Wash.* Friday Harbor (Clark) 1923; Martins Bluff (Rakestraw) 1938; Pacific Beach (Foster 1501) 1911; Seattle (Frye) 1904.

TYPE LOCALITY: European.

RANGE: Me. (203), Vt. (176), Mass. (142), R. I. (140), Conn. (169), N. Y. (4), Pa. (337.09), Ont. (373), Ind. (512.1), Ill. (529), Wis. (79.4), Alta. (51), B. C. (373), Ida. (281), Wash. (81), Ore. (457), N. C. (43), Va. (127), D.C. (343), W. Va. (3.2), Ky. (218); Mex. (224); Guadalupe Isl. (498.1); Tropical Amer. (212); S. Amer. (132); Antarctic Amer. (212); Hawaiian Isls. (226); Java (226); Asia (404); Eur. (317.2); Azores (58.56); Madeira (58.56); Canary Isls. (226); Africa (393); St. Helena Isl. (54); Crozet Islands (325).

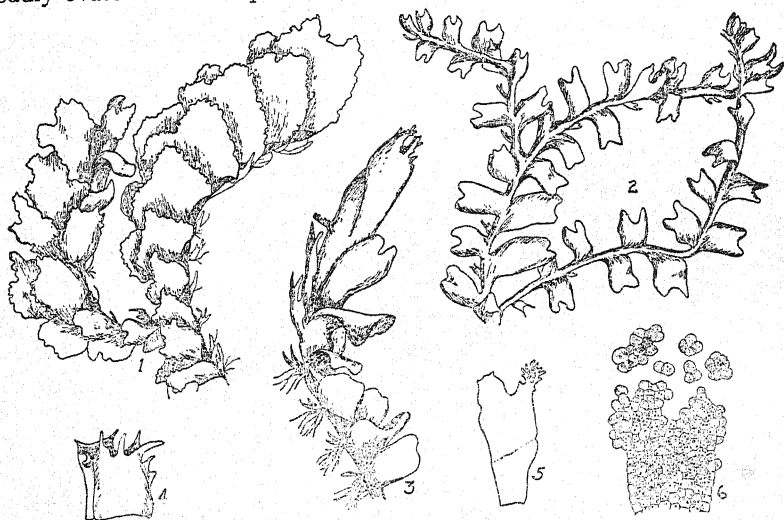
3. *Lophocolea minor*<sup>82</sup> Nees Naturg. Eur. Leberm. 2:330, 1836.

*Jungermannia crocata* DeNot., Mem. Accad. Torino 2(1):323, 1839.

*L. crocata* Nees, in G. L. & N. Syn. Hep. 160, 1845.

*L. heterophylla* var. *minor* Douin, Revue Bryol. 34:23, 1907.

Plants in mats, yellowish green; leafy shoots 1-2 mm wide. Stems 0.5-1.5 cm long, prostrate, slender, green, much branched; branches originating laterally or occasional ones ventrally. Rhizoids moderately common, in tufts at the bases of the underleaves. Leaves alternate, quite strongly succubous, somewhat decurrent dorsally, rather distant to loosely imbricate, horizontally spreading to dorsally second, simply 2-lobed, broadly ovate to almost quadrate, 250-380  $\mu$  long, 200-250  $\mu$  wide, widest



*Lophocolea minor*. 1, Gemmiparous plant,  $\times 7.5$ . 2, Sterile plant, dorsal view,  $\times 12$ . 3, Tip of plant with gemmiparous perianth,  $\times 7.5$ . 4, Mouth of perianth,  $\times$  about 15. 5, Female bract, gemmiparous,  $\times 7.5$ . 6, Gemmiparous leaf,  $\times 60$ . (All after Clark & Frye.)

in the middle, abruptly narrowed to the base; margins entire, or erose through the formation of gemmae; lobes often unequal with the ventral the larger, acute to rounded but most of them bluntly acute to obtuse or rounded to entirely disappearing in the formation of gemmae; sinus descending  $\frac{1}{4}$ – $\frac{1}{3}$  the leaf length, rarely acute, mostly right-angular to crescentic. Cells of the leaf middle 25-30  $\mu$ , of the lobes about 20  $\mu$ ; walls thin; trigones wanting to minute; oil bodies up to 6 per cell; cuticle smooth. Gemmae almost always quite common and the gemmiparous leaves becoming abnormal in form, gemmae on the tips and margins of the leaves, rarely on the underleaves, sometimes also on the female bracts

<sup>82</sup> mi' nör.



and the perianth, at first 1-celled and spherical, forming 2- to many-celled groups or filaments, yellowish green, about  $25\ \mu$ . Underleaves present throughout or nearly so, comparatively small,  $\frac{1}{3}$ – $\frac{1}{2}$  as long as the leaves, 2-lobed for  $\frac{1}{2}$ – $\frac{3}{4}$  the length, sometimes with an additional tooth or lobe on each outer margin near base, the margins otherwise entire; the lobes spreading, lanceolate. Plants mostly unisexual but rarely bisexual. Male plants in separate sods or occasionally intermingled, on bisexual plants the male bracts just below the female ones; male bracts with a saccate lobule at the base of the dorsal margin; antheridium 1. Female inflorescence terminal on a main stem or a well developed branch, sometimes becoming apparently lateral through subfloral rejuvenation; female bracts larger than the leaves of sterile stems, applied to the perianth for most of its length, elongate-rectangular, shortly 2-lobed for  $\frac{1}{6}$ – $\frac{1}{5}$  the length; the lobes blunt or rounded, occasionally gemmiparous; bracteole about half as large as the bracts, 2-3-lobed. Perianth small, narrow, sharply 3-angled in the upper half, occasionally gemmiparous; mouth 3-lobed, the lobes very coarsely toothed. Seta about  $500\ \mu$  long. Sporangium about  $500\ \mu$  long, yellowish brown, smooth. Elaters 8-10  $\mu$  wide; spirals 2, reddish brown. Spores about  $10\ \mu$ , smooth. The name the *L. minor*, the smaller; on account of its small size in comparison with other species of the genus. —On shaded rocks, banks of streams, bases of trees, rotten logs; preferably on calcareous substratum.

ILLUSTRATIONS: Clark & Frye (81) 98, figs. 1-6; K. Mueller (409) 1: figs. 346 D, 351-352; Pearson (431) pl. 10; Gil (76) fig. 257; Warnstorf (523) 256, fig. 2; Steere (385.5) 60, figs. 7-8; Ammons (3.1) 138, fig. D; Jensen (323.5) 187, 2 figs.

EXAMINATIONS: *Colo.* Rock Springs Pass (Rakestraw) 1938.—*Ida.* Craig Mt. (Clark) 1924.—*Ill.* Morton (Drexler 1229) 1937; Urbana (Drexler 1621) 1939.—*Iowa.* Winneshiek County (Conard) 1937.—*Que.* Quetico Provincial Park (Drexler 2149) 1939.

TYPE LOCALITY: European.

RANGE: N. S. (53), N. B. (373), Me. (430), N. H. (142), Vt. (169), Mass. (168), R. I. (140), Conn. (140), N. Y. (58), Que. (178), Pa. (3.1), Ont. (373), Ind. (427), Mich. (485.5), Ill. (246.5), Wis. (79.3), Minn. (94.1), Iowa (89), Alta. (373), Yukon (51), B. C. (373), Ida. (81), Colo., Ky. (3.1), W. Va. (3.1), Va. (474.5), D. C. (343); Asia (19.05); Eur. (325).

4. *Lophocolea cuspidata*<sup>83</sup> (Nees) Limpr., in Cohn Krypt-Fl. Schlesien 1:303, 1876.

*L. bidentata* var. *cuspidata* Nees Naturg. Eur. Leberm. 2:327, 1836.

*L. hookeriana* var. *prolifera* Nees Naturg. Eur. Leberm. 3:368, 1838.

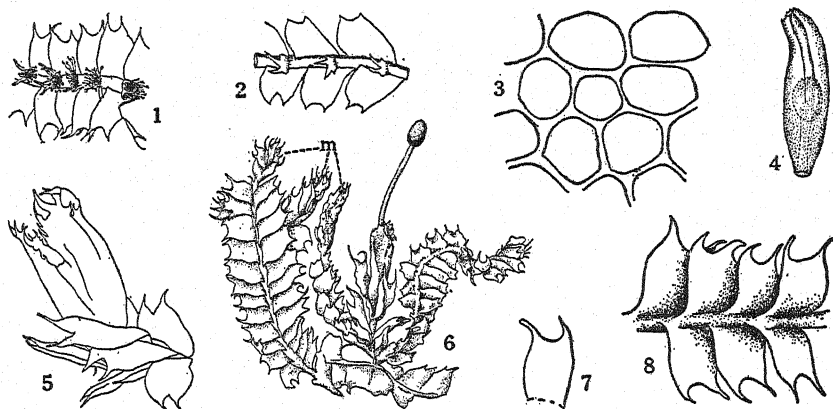
*L. bidentata* var. *ciliata* Velenovsky, Rozpr. Ceske ak. Frant. Jos. 11:4, 1902.

*L. leibergii*<sup>84</sup> Underwood & Cook Hep. Amer. Exsic. No. 7, November, 1887, but without description. Steph., Bull. Herb. Boissier, Ser. 2, 7:486, 1907; also Sp. Hep. 3:186, 1907.

Plants in patches, pale yellowish green; leafy shoots about 3 mm wide. Stems 0.6-2 cm long, prostrate to procumbent, 150-270  $\mu$  thick, branched; branches numerous, spreading, arising between the ventral margin of a leaf and the underleaf, at almost a right angle to the stem, occasional ones dichotomous in origin. Rhizoids few to moderately abundant. Leaves alternate, quite succubous, the line of insertion extending half around the stem, somewhat decurrent dorsally, imbricate, spreading, simply 2-lobed at tip, rectangular to broadly triangular, 0.6-1.6 mm long, 0.4-1.3 mm wide, widest at or near base; margins entire, the two nearly equally curved; lobes equal or nearly so, triangular, longly acuminate, mostly parallel but some convergent or divergent; sinus descending  $\frac{1}{5}$ - $\frac{1}{4}$  the leaf length or in small leaves sometimes to  $\frac{1}{3}$ , crescentic or in small leaves sometimes right-angular. Cells of the leaf middle 30-48  $\mu$ , of the lobes 25-34  $\mu$ ; walls thin; trigones wanting or minute; cuticle smooth. Gemmae unknown. Underleaves comparatively large, erect-spreading, somewhat decurrent at both margins, 2-lobed for  $\frac{3}{5}$ - $\frac{3}{4}$  the length; the lobes subulate to lanceolate, acuminate, each with a tooth or lobe at its outer base. Plants bisexual; both male and female branches originating between underleaf and ventral margin of leaf. Male branches beneath the perianth, much narrower than the sterile branches; male inflorescence spicate, terminal on the branch or rarely farther down; male bracts smaller than the leaves of sterile plants, rather numerous, ovate, 2-lobed, somewhat saccate at base, the lobes less acuminate than the leaves, the margin inflexed, the dorsal lobe the larger, the dorsal margin with a basal tooth bent upward along the stem; antheridium 1, large, 250-300  $\mu$  thick. Female branch with age sometimes apparently a main shoot; female bracts applied to the perianth for  $\frac{3}{4}$  their length, much larger than the leaves of sterile stems, broadly ovate to elliptic, 2-lobed for about  $\frac{1}{3}$  the length; the margins usually entire, the dorsal one recurved; the lobes lanceolate to subulate, longly acuminate, ending in a cilium; the sinus narrow and acute; bracteole elliptic, almost as large as the bracts, 2-lobed for  $\frac{1}{3}$ - $\frac{2}{5}$  its length, the lobes reflexed and strongly acuminate, the sinus

<sup>83</sup> kūs pī dā' tā.

<sup>84</sup> We fail to find any characters on which to separate this from *L. cuspidata*. Stephani (491) bases the distinction on the female bracts, but there is too little difference for even a good variety. John W. Bailey found it in Washington (491). We have examined the material in his herbarium and found it to be *Calypogeia fissæ*.



*Lophocolea cuspidata*. 1, Part of plant, ventral view,  $\times 5.3$ . 2, Part of plant, ventral view,  $\times 4$ . 3, Median leaf cells,  $\times 260$ . 4, Perianth,  $\times 4.7$ . 5, Tip of plant with perianth,  $\times 5.3$ . 6, Part of plant with sporophyte and three male (*m*) branches,  $\times 3$ . 7, Leaf,  $\times 6$ . 8, Part of plant, dorsal view,  $\times 7$ . (1, 5, after Jensen; 2, after Chalaud; 4, after Pearson; 6, after K. Mueller; 3, 7-8, original by Helen M. Gilkey.)

narrow and rounded or gibbous at base. Perianths 2-3.5 mm long, 0.8-1.3 mm thick, usually abundant, oblong, 3-angled to the mouth, the angles acute and almost always more or less winged, sometimes the wings dentate, sometimes one of the keels united with one of the bracts; mouth 3-lobed for  $\frac{1}{4}$ - $\frac{1}{2}$  the length of the perianth; the lobes bifid, their margins dentate to ciliate; the cilia unequally long, large, sharply pointed. Sporangium ellipsoid, 1-1.2 mm long, 650-720  $\mu$  thick, dark brown; walls 3-5 cells thick; epidermal cells large, quadrate, with nodular thickenings; innermost cells of wall with numerous annular thickenings. Elaters 160-200  $\mu$  long, 8-12  $\mu$  thick, somewhat attenuate at tips; spirals 2. Spores 15-24  $\mu$ , minutely punctate, brown. The name the *L. cuspidatus*, having a cusp or point; probably in reference to the lobes of the leaves.—On wet rocks or walls, on sandy or clayey banks or flats, on wet or decaying wood or on bases of trees in wet places.

ILLUSTRATIONS: Pearson (433) 2: pl. 102; Macvicar (374) 241, figs. 1-5; Gil (76) figs. 253-254; Douin, Bull. Soc. Bot. France 72: pl. 8, figs. 19-20; pl. 9: figs. 25, 27; pl. 10; 1925; Chalaud, Ann. Bryologici 4: pls. 52, 57, 63, 1931; Sanborn (457) 103, figs. 7-9; Jensen (323.5) 187, 2 figs.; K. Mueller (409) 1: figs. 346 H and 348; Meylan (386) fig. 131; Ammons (3.1) 138 fig. B.

EXAMINATIONS: Alaska. Heceta Island (Frye) 1913.—Ida. Moscow (Clark) 1923.—Ore. Portland (Foster) 1906.—Wash. Cathlamet (Foster) 1907; Friday Harbor (Clark) 1924; Mt. Baker (Svihla 392) 1932; Mt. Solo in Cowlitz County (Rakestraw) 1938; Spieden Island (Kirkwood) 1926.

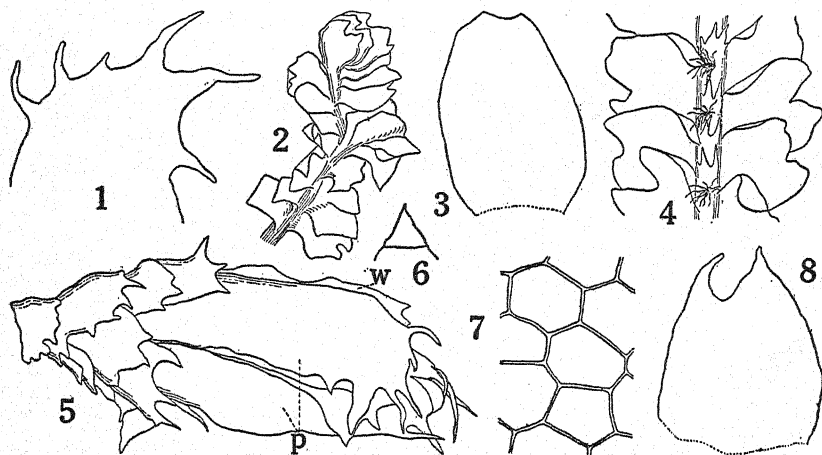
TYPE LOCALITY: "Sattlerschlucht bei Hirschberg und beim Kochelfall" in the Riesengebirge, Germany (Flotow) 1836.

RANGE: Tenn. (3.1), W. Va. (3.1), Pa. (157), Ill. (246.7), Mont. (81), Ida. (81), Alaska (373), B. C. (373), Wash. (81), Ore. (81), Cal. (296); Mex. (3.1); Asia (247.08); Eur. (523); Canary Isls. (325); Iceland (3.1).

5. *Lophocolea alata*<sup>85</sup> Mitt., in Larter, Trans. Devonshire Assn. Adv. Sci. Lit. Art 285, 1906.

*L. cuspidata* var. *alata* K. Muell., Rabenh. Krypt.-Fl. 6(1) :803, 1911.

Plants in patches, dark green to dark yellowish green. Stems 1-3 cm long, prostrate to procumbent, branches numerous. Rhizoids common. Leaves alternate, quite succubous, somewhat decurrent dorsally, imbricate, spreading to erect-spreading, simply 2-lobed at tip, rectangular to broadly triangular or ovate, convex; margins entire, the two not greatly unequal in curvature; lobes rather unequal with the ventral the larger, acuminate; sinus descending  $\frac{1}{3}$ - $\frac{1}{4}$  the leaf length, right-angular to rounded or crescentic. Cells of the leaf middle 33-50  $\mu$ , of the lobes 33-40  $\mu$ , rather opaque; walls thin; trigones wanting or minute. Gemmae unknown. Underleaves 2-lobed, commonly about  $\frac{1}{3}$  as long as



*Lophocolea alata*. 1, Lobe at the mouth of the perianth, x 22. 2, Tip of shoot, dorsal view, x 10. 3, Unusual leaf, x 22. 4, Part of shoot, ventral view, x 13. 5, Tip of shoot with perianth (*p*) showing wing (*w*), x 10. 6, Diagram of cross section of the perianth, x about 5.5. 7, Cells of the leaf middle, x 290. 8, Leaf, x 22. (All except 6 original by Elizabeth Curtis.)

the leaves, each margin with an additional tooth or subula; the lobes lanceolate-acuminate; the sinus  $\frac{1}{2}$ - $\frac{2}{3}$  the length of the underleaf. Plants bisexual; both male and female branches originating between the underleaf and the ventral margin of a leaf. Male branches beneath the perianth; male inflorescence spicate; male bracts smaller than the leaves of sterile plants, ovate, 2-lobed, somewhat saccate at base, the dorsal lobe the larger, the dorsal margin with a basal saccate tooth or lobule bent upward along the stem; antheridium 1. Female bracts larger than the leaves of sterile shoots, 2-lobed for  $\frac{1}{5}$ - $\frac{1}{4}$  the length, oblong-ovate,

<sup>85</sup> á lá' tá.



the margin entire; the lobes lanceolate to subulate, acuminate; the sinus narrow and acute; bracteole narrowly oblong to oval, 2-lobed for  $\frac{1}{5}$ – $\frac{1}{4}$  its length; the lobes subulate, entire, reflexed; the sinus acute to lunate. Perianth large, commonly present, longly exserted, oblong, 3-angled with one angle dorsal, one or more of the angles winged; wings more or less spinose-dentate or rarely all entire, 3-9 cells wide; mouth 3-lobed; the lobes acute to acuminate, their margins spinose-dentate to spinose-ciliate. Sporangium oblong-oval, dark brown. Elaters 9-10  $\mu$  thick, spirals 2, reddish brown. Spores 15-18  $\mu$ , nearly smooth, pale reddish brown. The name the *L. alatus*, having wings; in reference to the wings on the angles of the perianth.—On moist stones, walls and banks; often among mosses.

ILLUSTRATIONS: Macvicar (374) 242, figs. 1-6.

EXAMINATIONS: Ill. Urbana (Drexler 1621) 1939.

TYPE LOCALITY: Great Britain.

RANGE: Mass. (191), Conn. (95), N. Y. (59), Pa. (176), Ill.; Eur. (176).

6. *Lophocolea martiana*<sup>86</sup> Nees, in G. L. & N. Syn. Hep. 152, 1845.

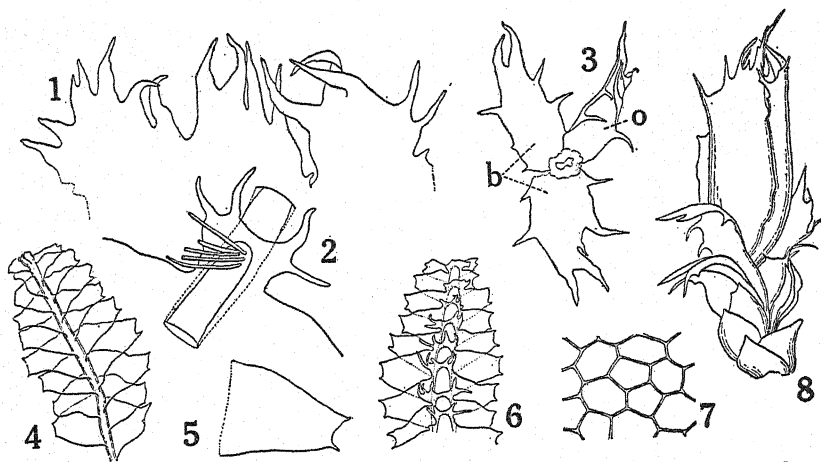
*Jungermannia connata* Nees, in Mart. Fl. Brasiliensis 1:332, 1833. Not of Sw. Prodr. Fl. Indiae Occidentalis 143, 1788 (= *L. connata* Sw. & Nees, in G. L. & N. Syn. Hep. 153, 1845).

*L. leiboldii*<sup>87</sup> Steph., Bull. Herb. Boissier, Ser. 2, 7:485, 1907; also Sp. Hep. 3:185, 1907.

Plants in low thin patches or mats, whitish green. Stems up to 6 cm long, prostrate, flaccid, greenish brown to reddish when dry, from little to much branched; the branches subfastigiate, long. Rhizoids numerous, in tufts at the bases of the underleaves, long. Leaves nearly opposite or more rarely quite so, quite strongly succubous, subimbricate, the bases  $\frac{2}{3}$  overlapping but the apices free, horizontally erect-spreading, simply 2-lobed or 2-toothed, tri-symmetrical, about 2.1 mm long and 1.6 mm wide or those on the branches shorter; apex wide, obliquely truncate; margins entire; lobes or teeth slender, acuminate-setose, often unequal with the ventral the larger, commonly divergent; sinus usually right-angular but varying from acute to lunate. Cells near the leaf tip about 36  $\mu$ , near the base about 36 by 54  $\mu$ ; walls thin; trigones wanting or small. Gemmae unknown. Underleaves about  $\frac{1}{4}$  the length of the leaves, 4-lobed to about  $\frac{2}{3}$  the length, slightly dilated at base, cuneate-quadrangle, united on each side or in occasional leaves on one side only with the adjacent decurrent leaf; lobes narrowly lanceolate to subulate, rather long, spreading. Plants bisexual. Male inflorescence long-spicate,

<sup>86</sup> mār tī ā' nā.

<sup>87</sup> There are no specific characters known on which to base a separation of *L. leiboldii* from *L. martiana*. Stephani described it, without figures, from sterile material from Arkansas, and it has not been found since.



*Lophocolea martiana*. 1, Lobes of the mouth of the perianth, x16. 2, Underleaf and union with leaf, x9. 3, Female bracts (b), and bracteole (o), x9. 4, Dorsal view of shoot, x3. 5, Leaf, x8. 6, Ventral view of shoot, x3. 7, Cells of the leaf middle, x160. 8, Tip of plant with perianth, x8. (All original, by Elizabeth Curtis.)

terminal on more tenuous lateral branches which arise near the female inflorescence; male bracts 16, small, about  $800\ \mu$  long, a little crowded, emarginate to distinctly 2-lobed, at the dorsal base with a saccate antheridial lobule bearing 2-3 spines; male bracteole large, connate with the bract on both sides, 2-lobed; its lobes erect, setaceous; each margin with 2-3 additional spines or bristles; antheridium 1. Female inflorescence terminal on a main shoot; female bracts about 2.3 mm long and 1 mm wide, larger than the leaves of sterile stems, closely applied to the perianth, coarsely 2-lobed, the ventral margin 2-3-lacinate, the apical sinus lunate; bracteole about  $2\frac{1}{2}$  times as long as the underleaves of sterile stems, about 1.5 mm long and 1 mm wide, cuneate-oblong, wide at apex, 4-spinose to  $\frac{1}{3}$  the length of the bracteole; spines double, subulate, acuminate, the inner divaricately 2-lobed, the outer larger. Perianth long-exserted, oblong, about 4 mm long and 1 mm thick; 3-angled with one angle dorsal, wall 1 cell thick except at very base; angles winged; the wings about 4 cells wide, dorsal one with 3 spines, the lateral ones only sinuate-denticulate; mouth deeply 3-lobed, the lobes again coarsely and deeply lobed. Named in honor of Karl F. P. von Martius, a noted botanist of Munich, Germany.—On soil in shade, on bases of trees and on rotting wood.

ILLUSTRATIONS: Martius, Icon. Pl. Crypt. pl. 17, fig. 2, 1828-1834; Kurz and Little (337) 36, fig. 57.

EXAMINATIONS: *Fla.* Port Orange (Straub) 1893; Sanford (Rapp) 1923.

TYPE LOCALITY: Brazil.

RANGE: Fla. (301); Mexico (224); West Indies (428.3); S. Amer. (226); Madagascar (491); Africa (491).

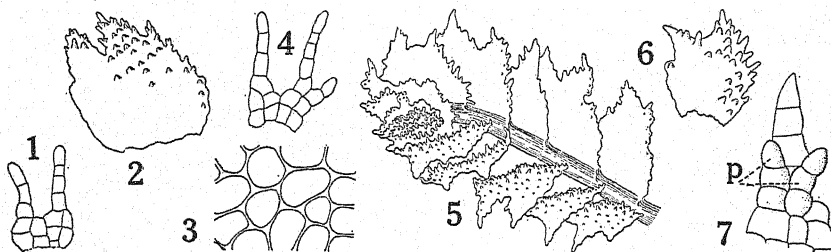
7. *Lophocolea muricata*<sup>ss</sup> (Lehm.) Nees in G. L. & N. Syn. Hep. 169, 1845.

*Jungermannia muricata* Lehm., Linnaea 4:363, 1829.

*L. hirtifolia* Tayl., London Jour. of Bot. 5:366, 1846.

*L. horridula* Sande-Lacoste Syn. Hep. Javanicarum 30, 1856. (In Verh. der K. Acad. vol. 5.)

Plants in loose patches or mats, whitish green. Stems up to 1.5 cm long, prostrate, green, delicate, flaccid; branches numerous, assurgent, about 5 mm long; apical innovations few. Rhizoids in tufts at the bases of the underleaves. Leaves opposite or nearly so, quite succubous, somewhat imbricate, recurved-spreading, semivertical, simply 2-lobed, ovate-triangular to oblong-rhomboidal, symmetric, about 400  $\mu$  long and 250  $\mu$  wide; margins ciliate, the dorsal almost straight, the ventral quite arcuate; cilia about 2-3 cells long, close together; lobes unequal with the ventral the larger, triangular, acute, often connivent; sinus descending  $\frac{1}{5}$ – $\frac{1}{4}$  the leaf length, acute. Cells of the leaf middle 18-20  $\mu$ , the basal ones somewhat longer, 4-6-angled; chloroplasts few; walls thin; trigones wanting; dorsal cuticle densely muriculate with 2-3-celled elevations. Gemmae



*Lophocolea muricata*. 1, Underleaf, x 160. 2, Leaf, x 68. 3, Cells of the leaf middle, x 293. 4, Underleaf, x 160. 5, Tip of plant, dorsal view, x 50. 6, Leaf, x 68. 7, One of the larger marginal projections with two papillae (p) on it, x 293. (All original, by Elizabeth Curtis.)

unknown. Underleaves about half as long as the leaves, ligulate-oblong, 200-250  $\mu$  long, 100-125  $\mu$  wide, 2-lobed to about  $\frac{1}{2}$  the length, erect, the surface not muriculate, connate with the adjacent leaf on one or both sides; lobes acute, ciliate at margin. Plants bisexual. Male inflorescence terminating a leafy branch, long-spicate; male bracts distinctly smaller than the leaves of sterile plants, imbricate, 2-lobed, with cellular dorsal papillae, the tip recurved, the margin ciliate; the antheridial lobule smooth on both sides; male bracteole more or less free; antheridium 1. Female

<sup>ss</sup> mū rī kā' tā.

inflorescence terminal on a main shoot; female bracts twice as large as the leaves of sterile stems, oblong-ligulate, about  $600\ \mu$  long and  $340\ \mu$  wide, unsymmetric, 2-3-lobed, recurved at tip; bracteole somewhat less appressed than the bracts, oval-ligulate, about  $500\ \mu$  long and  $250\ \mu$  wide, 2-lobed to about  $\frac{1}{2}$  its length, ciliate. Perianth about 4 times as long as the leaves of sterile plants, about 1.5 mm long and  $500\ \mu$  thick, ovoid-cylindric to somewhat clavate, laterally compressed, obscurely 3-angled when young, terete-compressed when old, densely hairy; mouth hardly constricted, 3-lobed to a depth  $\frac{1}{4}$  the length of the perianth or less, the lobes bifid through connivent cilia. Mature sporophyte unknown. So named from the muricate dorsal surface of the leaves.—On rocks, on decaying trunks of trees, on bark, or among mosses.

ILLUSTRATIONS: None.

EXAMINATIONS: S. C. Middle Saluda River (Taylor 2384) 1935.

TYPE LOCALITY: We do not have access to the original description.

RANGE: Fla. (491), S. C., La. (491); West Indies (478); Mex. (224); S. Amer. (474.8); Fiji Isls. (220); New Zealand (474.8); Tasmania (474.8); Australia (491); New Guinea (491); Java (491); Reunion Isl. (491); Africa (491).

#### SOUTHYOIDEAE<sup>89</sup>

Stems with few branches; branches from the axils of the leaves, or of the underleaves (in ours). Rhizoids in tufts at the bases of the underleaves. Leaves opposite or some of them not quite so, transversely or subobously inserted, unlobed (in ours), or 2-lobed, margins entire, or in the large leaves close to the female bracts sometimes toothed, in ours bordered with a row of cells with very thick walls. Cell walls of leaves thin to thick, the cell hollow polygonal (in ours), or rounded. Gemmae unknown, or in *Arnellia* about the middle of the ventral leaf margin. Underleaves wanting to abundant, small, free, or connate with both adjacent leaves but not with only one. Plants unisexual (in ours), or bisexual. Female bracts free, or united with each other (in ours), in some species also connate with the bracteole. Perianth present (in ours), or wanting. Perigynium present (in ours), or wanting, rhizoidous. Seta with cells in cross section all quite similar or with the epidermal cells distinctly larger. Sporangium ovoid (in ours), or cylindric, its wall of 2 layers of cells.

The Southbyoideae as here considered are held together chiefly by the opposite leaves. Possibly they are related to the genus *Lophocolea* in which the opposite leaves are more or less characteristic of certain species. The antheridia are not, however, associated with dorsal lobules. What seems to indicate lowness in this group is that in *Gongylanthus*, a

<sup>89</sup> south by ôi' dë ä.



European genus, the archegonia arise apically at the point where the margins of the female bracts meet dorsally. (See diagram, page 236.)

Only the following genus is represented in our North American area.

*ARNELLIA*<sup>90</sup> Lindb., Medd. Soc. Fauna Fl. Fennica 14:70, 1887.

*Jungermannia* Gottsche, in Gottsche & Rabenh. Hep. Eur. Exsic. No. 418, 1868.  
*Southbya* Hartm. Skand. Fl., Ed. 10, 2:130, 1871.

Plants in mats, bluish green, vigorous. Stems prostrate to decumbent; branches few, from the axils of underleaves. Rhizoids in tufts near bases of underleaves. Leaves opposite, connate in pairs dorsally, transversely or slightly succubously inserted, not decurrent, unlobed, entire except those just below the female bracts, bordered by a marginal row of cells with very thick walls. Cells of the leaves except the marginal row with thin walls; cell cavity angular; trigones from very small to large and bulging into the cell cavity. Gemmae present, 2-celled when mature. Underleaves common but quite small. Plants unisexual. Male inflorescence terminal or farther down the stem; male bracts not greatly different from the leaves. Female inflorescence terminal on a normal shoot, often becoming apparently lateral on account of the growth of branches from just below it, forming a perigynium; female bracts larger than the leaves, their margins sinuate to toothed. Perianth free, its base at the mouth of the perigynium, immersed in a series of bracts arising at mouth, shortly tubular. Calyptra with unfertilized archegonia on it to its tip. Perigynium at right angles to the stem, rhizoidous. Sporangium ovoid, 4-valved, its wall 2 cells thick; epidermal cells large, with nodular thickenings; inner cells of wall with semiannular thickenings. Elaters with 2 spirals. Spores 8-9  $\mu$ , densely papillose. Named in honor of H. W. Arnell, a bryologist of Upsala, Sweden.

1. *Arnellia fennica*<sup>91</sup> (Gottsche) Lindb., Medd. Soc. Fauna Fl. Fennica 14:70, 1887.

*Jungermannia fennica* Gottsche, in Gottsche & Rabenh. Hep. Eur. Exsic. No. 418, 1868.

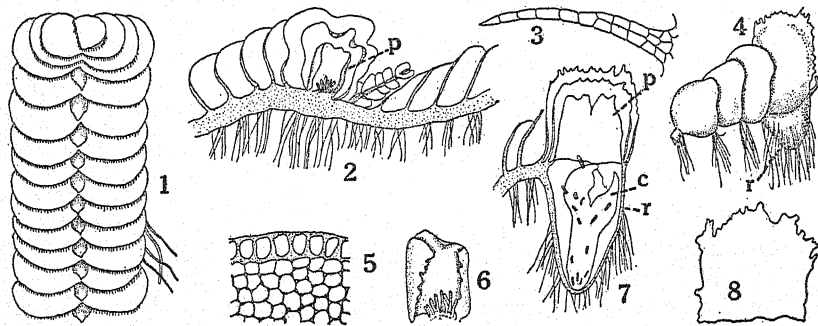
*Southbya fennica* Gottsche, in Gottsche & Rabenh. Hep. Eur. Exsic. No. 418, 1868.

Plants in mats, bluish green; leafy shoots up to 3 mm wide. Stems 1-2 cm long, prostrate or decumbent, mostly unbranched, sometimes with a few branches from the axils of the underleaves. Rhizoids in tufts near bases of underleaves, long. Leaves opposite, on the upper side with bases united in pairs, transversely or somewhat succubously inserted, not decur-

<sup>90</sup> är näl' li ä.

<sup>91</sup> fën' nī kã.

rent, contiguous to crowdedly imbricate, erect-spreading to spreading, unlobed, oval to circular; apex rounded; margin entire except just below the bracts, bordered by a row of roundish cells with very thick walls. Cells of the leaf middle hexagonal, 24-40  $\mu$  in longest diameter, sub-marginal ones 14-24  $\mu$ , the marginal row 20-35  $\mu$ ; walls thin; trigones from hardly distinguishable to large and bulging into the cell cavity; cuticle from almost smooth to finely papillose. Gemmae about 16 mm in diameter, oval, brown, 2-celled or the young ones 1-celled, about the middle



*Arnellia fennica*. 1, Part of sterile plant, dorsal view, x 8.6. 2, Longitudinal section of shoot with dorsal unfertilized group of archegonia within the perianth (*p*), x 12.7. 3, Underleaf, x 53. 4, Tip of shoot, side view, with perigynium (*r*), x 12.7. 5, Leaf cells along margin, x 116. 6, Perianth opened to show group of archegonia, x 21. 7, Longitudinal section of perigynium (*r*) containing calyptra (*c*) with unfertilized archegonia upon it; also perianth (*p*), x 21. 8, Female bract, x 25. (All after K. Mueller.)

of the dorsal border of the leaf. Underleaves quite small, often difficult to find on account of the rhizoids, subulate, the tip bent toward the stem. Plants unisexual. Male plants more slender; their bracts crowded, strongly concave; antheridia 1-3, usually 1; paraphyses none. Female inflorescence terminal on a normal shoot, often appearing lateral through the growth of branches from just back of it, the end of the stem forming a perigynium; female bracts larger than the leaves of sterile stems, on the top of the perigynium, quadrate, connate, often sinuate to somewhat toothed at margin. Perianth free from the bracts but immersed in them, at the top of the perigynium, shortly tubular; mouth truncate, wide, cleft, crenulate by projecting cells. Perigynium large, at right angles to the stem, comparatively thin walled, rhizoidous. Calyptra rather delicate, immersed in the perigynium, with unfertilized archegonia on it to its tip. Seta about 3 mm long and 500 thick. Sporangium ovoid, yellowish brown; valves 4; wall 2 cells thick; epidermal cells large, with nodular thickenings; inner layer of wall cells much smaller, with yellowish brown semiannular thickenings. Elaters with 2 spirals, 9-10  $\mu$  thick; spirals

yellowish brown, loosely wound. Spores 8-9  $\mu$ , yellowish brown, densely papillose. The name from Finland, in which it was first collected.—In cold regions on calcareous rocks covered with a thin layer of humus, or on soil or logs.

ILLUSTRATIONS: K. Mueller (409) 1: figs. 262-263; Meylan (386) fig. 71.

EXAMINATIONS: *Alta*. Banff (Brinkman 437) 1912 and (Brinkman 750) 1913. —*B. C.* Cinder Hill (Brinkman 233a) 1910. —*Ellesmere Isl.* (Pere Dutilly 1272) 1936.

TYPE LOCALITY: "In russische Karelien" (Simming) 1863.

RANGE: Greenland (325), Pim Isl. (56.01), Ellesmere Isl. (409), North Devon Isl. (409), Yukon (51), B. C. (373), Alta. (51), Manitoba (373); Asia (329); Eur. (325); Spitzbergen (329).

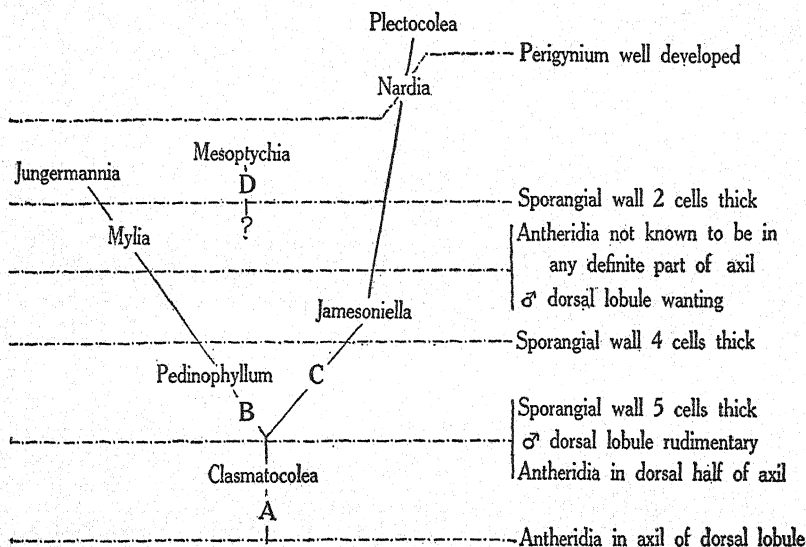
#### NARDIOIDEAE<sup>92</sup>

Plants green to brownish or reddish, sometimes blackish red. Stems prostrate to erect, laterally branched. Rhizoids mostly scattered, in a few tufted, colorless to brownish or purplish to violet. Leaves alternate, transversely to quite succubously inserted, dorsally or not at all decurrent, unlobed to merely emarginate at tip; margins entire or sinuate to crenulate. Cells of the leaves with the walls thin or somewhat thickened; trigones from wanting to bulging. Underleaves from wanting to present throughout. Plants unisexual or bisexual. Female inflorescence terminating an ordinary leafy shoot. Perianth greatly to not at all contracted, when greatly contracted the mouth sometimes shortly tubular; free or more or less united with the bracts. Sporangium spherical with straight valves; wall 2-5 cells thick, the innermost layer with semiannular thickenings.

We follow with some exceptions Joergensen (325) in recognizing a Nardioid group. It comprises the genera of the Jungermanniaceae of Evans (Bot. Review 5:49-96, 1939) with essentially unlobed alternate leaves. We conceive it as possibly related to the Lophocoleoideae through *Pedinophyllum* and *Jamesoniella* in which the antheridia are in the dorsal part of the male bract covered by an inflated dorsal lobule. The group is perhaps a natural one so far as our present limited knowledge of detail of essential morphology indicates.

<sup>92</sup> nār dĩ ỏi' dẽ ẽ. Nardieae of Joergensen, Bergens Mus. Skrift. 16:90, 1934, in larger part.

- A. Underleaves present but sometimes scarce on sterile nongemmparous shoots.
- B. Rhizoids brownish to reddish when mature.
- C. Leaves quite succubous; underleaves usually present only near the tip of the shoot; plants bisexual; perianth not contracted to mouth..... *Pedinophyllum*, p. 269.
- CC. Leaves transverse or little succubous; underleaves present throughout; plants unisexual; perianth suddenly contracted to mouth..... *Mesoptychia*, p. 305.
- BB. Rhizoids colorless even when mature.
- D. Perianth more or less united with the bracts.
- E. Leaves of sterile shoots oblong-oval; walls of median leaf cells thin, trigones medium in size; underleaves scarce; wall of sporangium 4 cells thick; male bracts with 2 teeth at base of dorsal margin. .... *Jamesoniella*, p. 271.
- EE. Leaves of sterile shoots about as wide as long; walls of median leaf cells somewhat thick, trigones wanting or small; underleaves rather common; wall of sporangium 2 cells thick; male bracts entire..... *Nardia*, p. 306.
- DD. Perianth free from the bracts or unknown.
- F. Underleaves with numerous hyaline papillae; rhizoids scattered, few; leaves mostly somewhat overlapping; leafy shoots 1.5-2.3 mm wide..... *Jungermannia allenii*, p. 279.
- FF. Underleaves without hyaline papillae, rhizoids tufted and numerous, or when few the leaves distant and the leafy shoots only 250-350  $\mu$  wide. .... *Mylia*, p. 299.
- AA. Underleaves wanting on sterile nongemmparous shoots.
- G. Perianth free from the bracts..... *Jungermannia*, p. 275.
- GG. Lower part of the perianth united with the bracts.<sup>93</sup>.... *Plectocolea*, p. 318.



Phylogenetic diagram of North American Nardioideae.

<sup>93</sup> In *P. crenulata* the perianth is sometimes free, but this species is easily recognized by its marginal leaf cells, which are 2-3 times as large in area as those of the second row.



## RELATIONSHIPS AMONG NORTH AMERICAN NARDIOIDEAE

The remarks under the letters below are pertinent at the corresponding letters on the diagram on opposite page.

- (A) Unknown whether female bracts are free from the perianth.
- (B) Female bracts free from the perianth.
- (C) Female bracts more or less united with the perianth.
- (D) Perianth and sporophyte too largely unknown to relate the plant.

PEDINOPHYLLUM<sup>94</sup> Lindb., Bot. Not. 156, 1874.

*Plagiochila* Dum. Rec. d'Obs. 15, 1835, in part.

*Plagiochila* subgenus *Pedinophyllum* Lindb., Not. Fauna Fl. Fennica 13:366, 1874.

Plants in patches or mats. Stems prostrate with ascending tips, with numerous branches; in cross section without differentiated cortical region; branches arising in the dorsal half of the leaf axil, often again branched. Leaves very succubously inserted, hardly decurrent dorsally, usually unlobed but sometimes 2-lobed, rounded-rectangular, plane; margin most often entire but sometimes distantly toothed; apex rounded when unlobed. Cell walls of leaf thin; trigones wanting or minute. Gemmae unknown. Underleaves present. Plants bisexual. Male inflorescence not terminal, below the female one on the same branch, or usually on lateral branches which often arise from the axil of a female bract; male bracts 8-10, the dorsal margin incurved forming an inflated hollow near base; paraphyses wanting among antheridia. Female inflorescence terminal; female bracts little larger than the stem leaves; bracteole almost always wanting. Perianth laterally compressed; mouth crescentic, sinuate to shortly and distantly dentate. Seta about 1 cm long. Sporangium ovoid-globose, its wall of 5 layers of cells; epidermal cells large, the walls with nodular thickenings; cells of the innermost layer with semiannular thickenings. Name from Gk. *pedinos*, flat or plane, and *phyllon*, leaf; in reference to the flat leaves as compared with those of *Plagiochila*, from which this genus was separated.

1. *Pedinophyllum interruptum*<sup>95</sup> (Nees) Lindb., Bot. Not. 156, 1874.

*Jungermannia interrupta* Nees Naturg. Eur. Leberm. 1:165, 1833.

*Plagiochila interrupta* Dum. Rec. d'Obs. 15, 1835.

*Jungermannia dumortieri* Libert Pl. Crypt. Ardennes 4:311, 1837.

*Plagiochila microstoma* Sull. Musci Alleghanienses 53, No. 221, 1846.

*Plagiochila pyrenaica* var. *interrupta* Lindb., Not. Fauna Fl. Fennica 13:367, 1874.

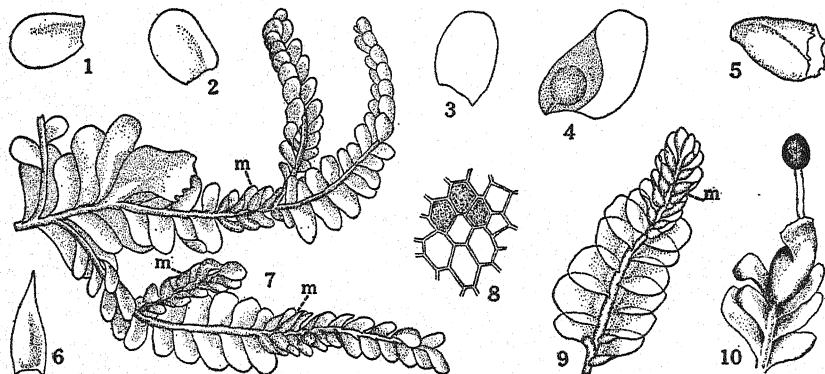
*Leptoscyphus interruptus* Lindb. Musci Scand. 4, 1879.

*P. pyrenaicum* var. *interruptum* Schiffn., Engler & Prantl Nat. Pfl.-Fam. 1(3):89, 1893.

<sup>94</sup> pēd i nō' fýl lūm.

<sup>95</sup> in tēr rūp' tūm.

Plants in patches or mats, yellowish green to olive brown. Stems 1.5-4 cm long, prostrate with ascending tip, irregularly branched, flexuous, leafy throughout; branches from the dorsal half of the leaf axil. Rhizoids rather numerous to near apex, rather long, brownish. Leaves alternate, distinctly succubous, hardly decurrent dorsally, imbricate, erect-spreading to spreading, mostly rather horizontal, not lobed or barely retuse, oval-quadrangle; apex rounded to retuse with the sinus wide; margin entire or occasionally with one or more distant teeth. Cells of the leaf middle 23-30  $\mu$ , of the margin 20-23  $\mu$ , of the base 30-35  $\mu$ , opaque, rounded-



*Pedinophyllum interruptum*. 1-2, Leaf, x 10.2. 3, Leaf, x 10.6. 4, Male bract with antheridium, x 21. 5, Perianth, x 47. 6, Underleaf, x about 100. 7, Plant with male (m) inflorescences, x 6.8. 8, Cells of the leaves, x 254. 9, Shoot with male (m) bracts, x 6.8. 10, Branch with perianth, x 10.2. (3, 7, after K. Mueller; 4, 8, after Warnstorf; 10, after Meylan; the others after Pearson.)

polygonal, the marginal ones somewhat 4-sided; walls rather thin; trigones minute to wanting; oil bodies numerous, spherical; cuticle smooth. Gemmae unknown. Underleaves usually present only near tips of branches, minute, filiform to triangular, simple or 2-lobed. Plants bisexual. Male inflorescence rarely terminal, nearly always farther down along the branches; male bracts 8-10, closely imbricate, erect concave, saccate at base, the dorsal margin involute forming a small rounded antheridial lobe which is inflated at base; antheridia usually 1, oval-globose. Female bracts similar to the leaves, larger, the margins recurved; bracteole wanting. Perianth broadly obovate, slightly longer than wide, about  $\frac{1}{3}$ - $\frac{1}{2}$  emergent, laterally compressed, slightly narrowed toward mouth; mouth wide, somewhat 2-lipped, crenulate to denticulate. Seta about 1 cm long. Sporangium oval-globose, dark brown, its wall of 5 layers of cells; epidermal cells large, with nodular thickenings; inner cells of wall with semiannular thickenings. Elaters 180-200  $\mu$  long, about 12  $\mu$  wide,

spirals 2, loosely coiled, reddish brown. Spores about 12-15  $\mu$ , nearly smooth, yellowish brown to reddish brown. The name from the interruption of the leafy shoots by the smaller bracts of the intercalary male inflorescence.—On moist banks, on decayed wood, on calcareous rocks; in shade.

ILLUSTRATIONS: Pearson (433) 2: pl. 111; Carrington, Brit. Hep. pl. 3, fig. 11, 1875; K. Mueller (409) 1: fig. 341-342; Meylan (386) fig. 128; Macvicar (374) 233, figs. 1-3; Underwood (506) pl. 24; Sullivant (498) pl. 8; Gil (76) fig. 250; Warnstorf (523) 165, fig. 8; Leitgeb, Unters. Leberm. 2: pl. 10, fig. 15, 1875.

EXAMINATIONS: Conn. Salisbury (Lorenz) 1916.—N. Y. Washington County (Burnham) 1915.—Ohio. Champaign County (Taylor) 1922.

TYPE LOCALITY: Krenzacher Horn near Basel, Switzerland (brother of Nees) April 18, 1813.

RANGE: Greenland (127.1), Labrador (373), Conn. (159), N. Y. (58), Ont. (373), Ohio (498), Ill. (246.5), Alta. (51), B. C. (373); Eur. (523); Asia (159.)

Buch, Evans & Verdoorn (Ann. Bryologici 10(1937):4, 1938) mention only *Plagiochila pyrenaicum* as occurring in Europe, which may imply that all European material of the genus has been referred to that species. *Plagiochila pyrenaicum* is not very sharply separated from *P. interruptum*, and is usually considered a variety of it.

JAMESONIELLA<sup>80</sup> (Spruce) Shiffn., Engler & Prantl, Nat. Pfl.-Fam. 1(3):1:82, 1893.

*Jungermannia* in part, of Schrader and others.

*Aplozia* Dum. Hep. Eur. 55, 1874, in part.

*Jungermannia* subgen. *Jamesoniella* Spruce, Jour. Bot. 14:26-29, 1876.

Plants large, forming mats, often reddish yellow or purple. Stems ascending to erect, apex curved toward the dorsal side, often rigid, innovating below the female inflorescence. Leaves alternate, succubous, almost half-clasping the stem, erect-connivent on the upper part of the stem, entire, ovate to subrotund, trigones small to large. Underleaves wanting or minute except with the female bracts. Plants unisexual or rarely bisexual. Male plants in separate tufts when bisexual; male bracts terminal or farther down the stem, ventricose, with an inflated dorsal lobule. Female bracts larger than the foliage leaves, more or less ciliate or lacinate; bracteole large, ciliate or lacinate. Mature perianth  $\frac{1}{2}$  or more emergent, united with the bracts for a part of its length, oblong-ovate to clavate, deeply 4-10 plicate toward tip, somewhat contracted toward the mouth; mouth wide. Sporangium wall of 4 layers of cells; epidermal cells with nodular thickenings; the 3 inner layers of cells with semiannular and annular thickenings. The name is the diminutive of the fern genus *Jamesonii*, which was named in honor of Dr. William Jameson of Quito, Ecuador.

<sup>80</sup> jā'm" sōn ī ēl' lā.

- A. Leaf cells with thin walls; underleaves scarce; not large; plants unisexual; perianths moderately abundant. . . . . 1. *J. autumnalis*.  
 AA. Leaf cells with thin walls; underleaves scarce to moderately abundant, sometimes large; plants unisexual; perianths little known. . . . . 1a. var. *heterostipa*.  
 AAA. Leaf cells with thick walls; underleaves mostly limited to the female inflorescence, not large; plants unisexual or sometimes bisexual; perianths very numerous. . . . . 1b. var. *myriocarpa*.

1. *Jamesoniella autumnalis*<sup>97</sup> (DeCand.) Steph., Bull. Herb. Boissier, Ser. 2, 1:1029, 1901; also Sp. Hep. 2:92, 1901.

*Jungermannia autumnalis* DeCand. Fl. France 6:202, 1815.

*Jungermannia schraderi* of Ekart Syn. Jung. Germ. 39, pl. 11, fig. 97, 1831; of Aust. Hep. Bor.-Amer. Exsic. No. 27; of Underw. Hep. Amer. Exsic. No. 18. Not of Mart. Fl. Crypt. Erlangensis 180, pl. 6, fig. 55, 1817.

*Jungermannia subapicalis* Nees Naturg. Eur. Leberm. 1:310, 1833.

*Aplozia subapicalis* Dum. Hep. Eur. 56, 1874.

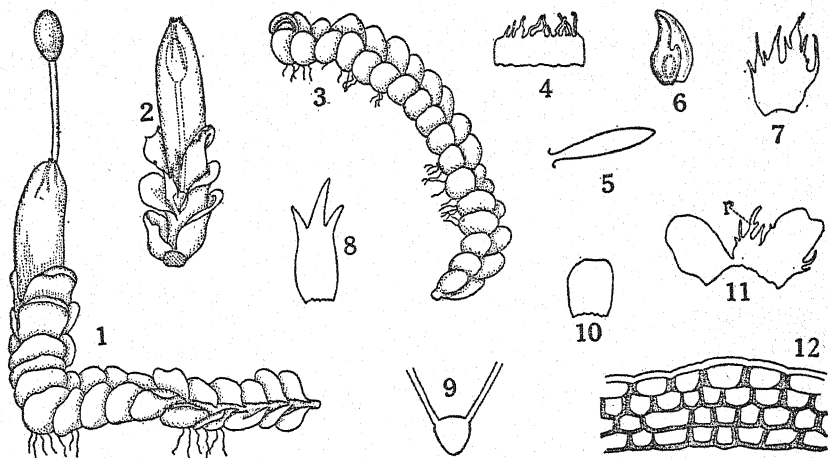
*Aplozia autumnalis* Heeg, Verh. Zool.-Bot. Gesell. Wien 43:80, 1893.

*Jungermannia rauana* Steph., Bull. Herb. Boissier, Ser. 2, 1:511, 1901; also Sp. Hep. 2:73, 1901.

Plants in dense patches, large, olive green or the tips glaucous green, reddish when old. Stems 1-4 cm long, prostrate, stout, simple or branched, often innovating below the bracts; branches arising from the ventral region of the leaf axil. Rhizoids numerous to near stem tip, hyaline. Leaves alternate, succubous, somewhat decurrent dorsally, crowded, imbricate, large, with a wide insertion, not or hardly bilobed, convex; those of lower part of stem horizontal, spreading, oblong-oval; those of the upper part of female stem appressed, roundish-oval; apex roundish to retuse; margin entire. Cells of the leaf middle 25-35  $\mu$ , of the margin about 20  $\mu$ , of the base 35-50  $\mu$ ; walls thin; trigones rather small, distinct; cuticle smooth or finely striate. Underleaves present only on younger parts, frequently obsolete, commonly narrowly lanceolate, or subulate. Plants unisexual. Male inflorescence along the median part of the stem, sometimes several in series on the same stem; bracts 8-12, erect, ventricose at base, closely imbricate, with 1-2 teeth on dorsal margin; antheridia solitary, large, on rather a long stalk. Female bracts rather larger than the foliage leaves, with or without a cilium-like tooth on one or both margins near base, transversely inserted, spreading at base, recurved at tip, oblong to roundish-oblong, rounded to emarginate at tip, often with 1-4 teeth or cilia on one or both margins near base, often adnate to the bracteole; bracteole larger than the bracts, lanceolate, sometimes bifid for  $\frac{1}{2}$  the length, laciniate; the lacineae 3-4, cilia-like, often hooked. Perianth united with the upper bracts for a small part of its length,  $\frac{1}{2}$ - $\frac{3}{4}$ -emergent, narrowly clavate-cylindrical, 4-5-plicate near mouth, slightly contracted at tip; mouth large, with long unequal cilia;

<sup>97</sup> a tũm nã' lĩs.





*Jamesoniella autumnalis*. 1, Plant with sporophyte, x 10.6. 2, Stem tip with perianth, dorsal view, x 10.6. 3, Sterile shoot, x 10.6. 4, Part of mouth of perianth, x 16. 5, Underleaf, x 32. 6, Male bract, x 12.7. 7, Female bract, which we believe to be a bracteole, x 10.6. 8, Female bracteole, in our definition an underleaf near the inflorescence, x 6.3. 9, Diagram of cross section of stem and bases of leaves, x about 21. 10, Leaf, x 10.6. 11, Female bracts and bracteole (*r*), x 10.6. 12, Cross section of wall of sporangium, x 106. (6, after Pearson; the others after K. Mueller.)

sterile perianth hardly emergent, ovate, plicate. Seta long. Sporangium cvoid, reddish purple, the walls composed of 4 layers of cells; epidermal cells with nodular thickenings on radial wall; cells of all three inner wall layers with semiannular thickenings. Elaters about 100  $\mu$  long and 8  $\mu$  thick, slightly attenuate; spirals 2, laxly coiled. Spores 11-15  $\mu$ , finely verruculose, reddish brown. Name the *L. autumnalis*, pertaining to autumn; the name is not particularly applicable to the species for the spores ripen in summer.—On ground, rocks or decaying wood.

ILLUSTRATIONS: Pearson (433) 2: pl. 129; Warnstorf (523) 154, fig. 1; Macvicar (374) 155, figs. 1-6; Meylan (386) fig. 87; Gil (76) fig. 223; Jensen (323.5) 99, 4 figs.; Steere (485.5) 70, figs. 1-3; Ammons (3.1) 140, fig. C.

EXAMINATIONS: *Ida.* Bonners Ferry (Rakestraw) 1937; Gibbonsville (Frye) 1929.—*Ill.* Urbana (Drexler 1267) 1937.—*Ind.* Turkey Run State Park (Drexler 1129) 1937.—*Iowa.* Giard Township, Clayton County (Conard) 1939.—*Mont.* Polson (Frye) 1928; St. Ignatius (Frye) 1934.—*N. C.* Winston-Salem (Schallert) 1924.—*N. Y.* Jamesville (Underwood) 1888; Risby Lake in Herkimer County (Haynes) 1906.—*Wash.* Darrington (Frye) 1932.—*Wyo.* Yellowstone National Park (Miller) 1934.

TYPE LOCALITY: France.

RANGE: Greenland (212); Miquelon Isl. (431), N. S. (53.2), N. B. (369), Me. (369.1), N. H. (359), Vt. (7), Mass. (232), R. I. (145), Conn. (203), N. Y. (4), Que. (178), Ont. (373), Pa. (338), Mich. (213), Ind. (94), Wis. (94), Iowa, Minn. (94.1), Mo. (212), Wyo. (84.2), Mont. (81), Alta. (46.2), B.C. (371), Ida. (82),

Wash. (84), Ore. (239), Tenn. (464), N. C. (43), Va. (271), Ky. (218.2), W. Va. (2.1), D. C. or Md. (444); Asia (448.2); Eur. (523).

There is a great deal of confusion between *Jamesoniella autumnalis* and *Jungermannia schraderi*, and this shows in the synonymy. The species as we conceive them are separable with certainty only by the mouth of the perianth. All the North American material referred to these two, so far as we know it, is *Jamesoniella autumnalis*. The following may be useful to check material which is believed to be *Jungermannia schraderi* Mart.:

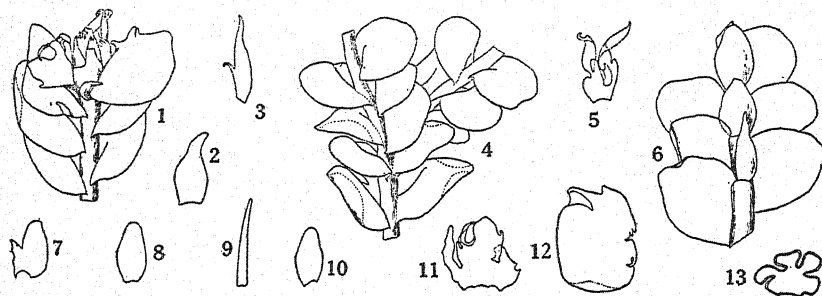
- a. Mouth of the perianth with cilia, each of which is composed of a single row of 4-10 cells..... *Jamesoniella autumnalis*.  
 aa. Mouth of the perianth with teeth, each of which is composed of 1-2 cells..... *Jungermannia schraderi*.

The inclusion of *Jungermannia schraderi* in Sullivant (498) and Underwood (504) (506) is not based upon *Jungermannia schraderi* Mart., but upon collections of *Jamesoniella autumnalis*. The mouth of the perianth is not drawn sufficiently clearly in Underwood (506) to make the species certain, but his description of the species is that of *Jamesoniella autumnalis* rather than *Jungermannia schraderi* Mart.

1a. *Jamesoniella autumnalis* var. *heterostipa*<sup>98</sup> (Evans) n. comb.

*J. heterostipa* Evans, Bryologist 18:65, 1915.

Plants dark green to brownish. Cuticle of the leaf smooth. Underleaves sometimes minute and evanescent, sometimes large and persistent, some of the largest up to 1.3 mm long and 750  $\mu$  wide; larger ones filiform to ovate, free or united on one side with the leaf; apex long-acuminate to rounded; margin entire. Plants probably unisexual. Male plants unknown. Upper two female bracts irregularly lobed and lacerate, with marginal teeth of various sizes. Perianth seen only when very immature;



*Jamesoniella autumnalis* var. *heterostipa*. 1, Tip of plant with perianth, dorsal view, x 6.3. 2, Underleaf, x 12.6. 3, Underleaf just beneath female bracteole, x 6.3. 4, Part of stem with branch, dorsal view, x 6.3. 5, Female bracts and bracteole, x 6.3. 6, Part of stem with well developed underleaves, ventral view, x 6.3. 7, Underleaf united with adjacent leaf, x 6.3. 8, Underleaf, x 6.3. 9, Underleaf, x 24. 10, Underleaf, x 6.3. 11-12, Female bracts and bracteole, x 6.3. 13, Cross section of perianth, x 24. (All after Evans.)

<sup>98</sup> hēt ēr ōs' tī pā.

mouth irregularly lobed; the lobes acuminate, their margins dentate to ciliate. Sporophyte unknown. Name from Gk. *heteros*, various, and *stipos*, a stalk or stem; apparently in reference to the various forms of underleaves.—On stones in streams.

ILLUSTRATIONS: Evans, Bryologist 18: pl. 1, 1915.

EXAMINATIONS: None.

TYPE LOCALITY: Barrington Passage, Cape Sable Island, Nova Scotia (Macoun 52), July 6, 1910.

RANGE: N. S. (77), Que. (95).

In our opinion it is at best a variety so far as now known, or possibly only a water form.

1b. *Jamesoniella autumnalis* var. *myriocarpa*<sup>99</sup> (Brink.) n. comb.

*J. myriocarpa* Brink., Bryologist 36:57, 1933.

Plants olive green. Cells of leaf with thick walls. Underleaves frequent near the inflorescence, rare farther down, variable in form and size, 1.3 mm or usually smaller, lanceolate to narrowly ovate, occasionally bilobed, rarely trilobed. Plants unisexual, or sometimes bisexual with the male bracts some distance below the female ones. Perianths numerous on the stems, close together, multiplicate. Sporophyte unknown. Name from Gk. *myrios*, innumerable, and *carpos*, fruit; in reference to the numerous perianths on a stem.—On rotten wood.

ILLUSTRATIONS: None.

EXAMINATIONS: None.

TYPE LOCALITY: Pictou, Nova Scotia (Macoun No. 967) July 24, 1883.

RANGE: Known only from the type locality.

We consider this as probably merely a plant unusually rich in reproduction. However, it might be best to keep it separate until there is more evidence of its relationship to the type.

JUNGERMANNIA<sup>100</sup> L. Sp. Pl. 1136, 1753, in part.

*Jungermannia* section *Aplozia* Dum. Syll. Jung. Eur. 47, 1831.

*Liochlaena* G. L. & N. Syn. Hep. 150, 1844.

*Solenostoma* Mitt., Jour. Linn. Soc. Bot. 8:51, 1865, in part.

*Aplozia* Dum. Hep. Eur. 55, 1874, in part.

*Haplozia* K. Muell., Rabenh. Krypt.-Fl. 6(1):535, 1909, in part.

Plants light green to brownish or blackish red. Stems prostrate to erect, with few or no branches. Rhizoids wanting to numerous, colorless

<sup>99</sup> mÿr i ô kär' pã.

<sup>100</sup> yüng êr mán' nî ä.

to brownish or virescent. Leaves alternate, from quite succubous to transversely inserted, dorsally or not at all decurrent, erect-appressed to spreading or horizontally spreading, obtuse to emarginate at tip, none more deeply 2-lobed, somewhat wider than long to almost twice as long as wide; margin entire or rarely subcrenulate to sinuate. Cells of the leaf middle 14-60  $\mu$ , of the margin 10-40  $\mu$ ; walls thin or only slightly thickened; trigones wanting to bulging; cuticle smooth or striate to papillose or verruculose. Underleaves wanting in most species, in some moderately common or occurring on gemmiparous shoots. Plants unisexual or bisexual; when bisexual the male inflorescence just below the female or farther down the shoot. Male inflorescence on an ordinary shoot, terminal in unisexual species; male bracts 6-24; antheridia 1-3 per bract. Female inflorescence terminal on an ordinary shoot; female bracts mostly larger than the leaves, sometimes equalling them or smaller, similar to them in form or more rarely wider; bracteole usually wanting. Perianth immersed to  $\frac{4}{5}$ -emergent, uniplicate to plicate toward tip, compressed laterally or dorsiventrally, or not compressed at all, widest at the middle or above or below it, contracted to mouth acutely to retusely; mouth entire to variously notched. Sporangium spherical to shortly ovoid to ellipsoid, its wall of 2 layers of cells; epidermal wall cells with nodular thickenings; inner wall layer with semiannular thickenings. Elaters 90-150  $\mu$  long; spirals 1 or usually 2, yellowish to reddish brown. Spores 10-30  $\mu$ , smooth to finely granulate or verruculose, brownish yellow to reddish brown. Named in honor of J. Jungermann, a German botanist of the 17th century.

Some authors do not use the genus *Jungermannia* L. at all, because the Linnean packet of *J. lanceolata*, the type species, is a mixture, and no plant in it agrees with his description. Some retain the Linnean name for the single species *J. lanceolata*, clearly described and referred to the genus by Schrader but not agreeing with the Linnean description, using the genus *Aplozia* for the others. Some authors use the genus *Jungermannia* for a considerable group with Schrader's *J. lanceolata* as the type. We doubt whether all these species will be left very long in the same genus. However, uniformity is more important in this group than the particular generic name until the detailed morphology of the species is known.

*J. allenii* may belong elsewhere when its reproduction is well known. *J. danicola*, *J. pendletonii*, *J. bolanderi* and *J. oblongifolia* are all much in need of observation concerning reproductive characters.



- A. Underleaves rather common; gemmae unknown..... 2. *J. allenii*.
- AA. Underleaves wanting or rarely present on shoots bearing gemmae.
- B. Trigones of old leaves large to bulging; perianth cylindrical, not plicate, retusely contracted to the mouth when mature..... 1. *J. lanceolata*.
- BB. Trigones of old leaves small or wanting; perianth more or less plicate at least near the mouth, not retuse at tip even when old.
- C. None of the leaves notched at tip.
- D. Leaves of sterile shoots not broadly cordate.
- E. Leaves of sterile stems inclined to be longer than wide.
- F. Rhizoids few; leaves of sterile shoots distinctly dorsally decurrent; plants light green..... 4. *J. bolanderi*.
- FF. Rhizoids numerous or moderately so; leaves of sterile shoots not or but little dorsally decurrent; plants olive green to blackish.
- G. Plants unisexual.
- H. Mouth of perianth crenulate; plants blackish; perianth fusiform to clavate..... 5. *J. oblongifolia*.
- HH. Mouth of the perianth 5-lobed, the lobes lacinate; plants yellowish green to olive green; perianth ovate to oblong-ovate..... 10. *J. atrovirens*.
- HHH. Mouth of the perianth 5-toothed, the teeth again toothed; plants olive green to blackish; perianth clavate to pyriform..... 11. *J. tristis*.
- GG. Plants bisexual.
- I. Leafy shoots about 1 mm wide; perianth fusiform..... 7. *J. pumila*.
- II. Leafy shoots about 2 mm wide; perianth cylindric to clavate..... 7a. var. *rivularis*.
- EE. Leaves inclined to be wider than long..... 8. *J. danicola*.
- DD. Leaves of sterile shoots broadly cordate.
- J. Rhizoids few; leafy shoots 2-4 mm wide; plants unisexual..... 6. *J. cordifolia*.
- JJ. Rhizoids numerous; leafy shoots about 0.5 mm wide; plants bisexual..... 9. *J. schiffneri*.
- CC. Some of the leaves retuse at tip.
- K. Rhizoids few; perianth entire; plants unisexual.... 3. *J. pendletonii*.
- KK. Rhizoids numerous; perianth crenulate to denticulate.
- L. Leafy shoots about 1.4 mm wide; plants bisexual.
- M. Leaf insertion dorsally about half crossing the stem; none of the leaves broadly cordate.
- N. Plants light green to brown; perianth clavate to obovoid..... 12. *J. sphaerocarpa*.
- NN. Plants reddish green to blackish red; perianth tubular..... 12a. var. *nana*.
- MM. Leaf insertion dorsally almost completely crossing the stem; leaves broadly cordate to circinate; plants light green to brown; perianth clavate to obovoid..... 12b. var. *amplexicaulis*.
- LL. Leafy shoots about 0.5 mm wide; plants unisexual..... 13. *J. caespiticia*.

1. *Jungermannia lanceolata*<sup>101</sup> Schrad. Sammlung, Liefg. 2:4, 1797. Not of L. Sp. Pl. 1131, 1753.

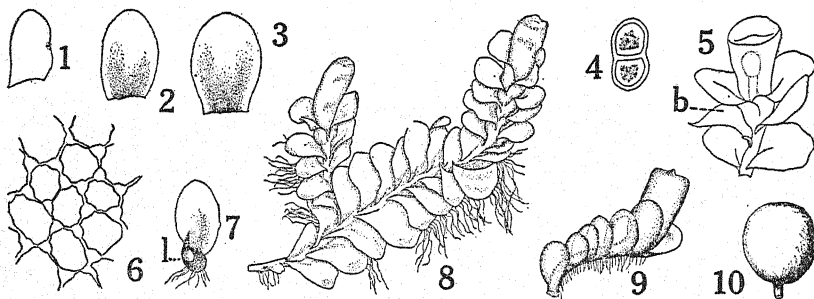
*Lioclaena lanceolata* Nees, G. L. & N. Syn. Hep. 150, 1844.

*Aplozia lanceolata* Dum. Hep. Eur. 58, 1874.

*Solenostoma lanceolata* Steph., Bull. Herb. Boissier, Ser. 2, 1:498, 1901; also Sp. Hep. 2:60, 1901.

*Haplozia lanceolata* K. Muell., Rabenh. Krypt.-Fl., Ed. 1, 6(1):572, 1909.

Plants forming flat mats, bright pale green to brown. Stems 2-4 cm long, thick, prostrate, irregularly branched. Rhizoids numerous to apex of stem, brownish. Leaves alternate, succubous on lower part of stem, nearly transverse on upper part, with dorsal margin decurrent, imbricate, spreading to horizontal, convex with the upper third reflexed, not bilobed, oblong-oval to oblong-rectangular; apex rarely retuse, usually rounded, sometimes obtuse; margin entire. Cells of the leaf middle 35-44  $\mu$ , of



*Jungermannia lanceolata*. 1, Leaf,  $\times 4.2$ . 2-3, Leaves,  $\times 8.5$ . 4, Gemma,  $\times 582$ . 5, Tip of plant with perianth, male bract (b) with dorsal lobule,  $\times 4.4$ . 6, Cells of the leaf middle,  $\times 210$ . 7, Male bract with dorsal lobule (l),  $\times 5.6$ . 8, Plant with perianth, dorsal view,  $\times 4.2$ . 9, Shoot with perianth, side view,  $\times 3.9$ . 10, Antheridium,  $\times 80$ . (1, 8, after K. Mueller; 2-3, 7, 9-10, after Pearson; 4, after Warnstorff; 5, after Jensen; 6, original, by Elsie K. Waddingham.)

the margin about 30  $\mu$ , rounded to polygonal, oblong at base, quite chlorophyllose; walls thin; trigones distinct, rather large to bulging; cuticle coarsely verrucose. Gemmiparous branches terminal, on sterile stems, delicate, erect, 2-5 mm long, with or without underleaves, with modified leaves; these leaves at the apex, scale-like, erect-appressed, composed of long thin-walled cells, gemmiparous at margin; gemmae rare, whitish green, round to ellipsoid, 2-celled. Underleaves wanting or sometimes present on gemmiparous branches. Plants unisexual or rarely bisexual. Male bracts usually below the female bracts or sometimes on separate plants, 6-8; antheridia 1-3, nearly globose, on short stalk. Female bracts a gradation from the leaves, slightly larger than the leaves, like them in form, nearly transverse, erect at base, spreading and squarrose above. Perianth usually terminal and at right angles to the stem, clavate-cylindrical.

<sup>101</sup> lăm" sã 6 lã' tă.

dric, incurved, not plicate, smooth, suddenly contracted to mouth and thus rounded-truncate at tip; mouth small, tubular, crenulate. Seta over 1 cm long; in cross section its cells many, about equal in size, not in definite groups. Sporangium ovoid, dark brown; epidermal cells large, with nodular thickenings; cells of the inner layer of the wall small, elongate, with semiannular thickenings on their walls. Elaters 8-10  $\mu$  thick; spirals 2, loosely wound, reddish brown. Spores 12-14  $\mu$ , nearly smooth, yellowish brown. Name from *L. lanceola*, a little lance; perhaps because the leaves are longer for their width than are those of its near relatives.—On wet rocks, on damp soil and wood; in shade.

ILLUSTRATIONS: Hooker (285) pl. 18; Underwood (506) pl. 25; Pearson (433) 2: pl. 120; Gil (76) fig. 222; K. Mueller (409) 1: fig. 286; Ekart (124) pl. 1, fig. 7; Meylan (386) fig. 86; Macvicar (374) 153, figs. 1-3; Warnstorf (523) 154, fig. 2; Steere (485.5) 74, figs. 3-4; Ammons (3.1) 140, fig. D.

EXAMINATIONS: *B. C.* New Denver (MacFadden) 1924.—*Ida.* Bovil (Clark) 1925.—*Ky.* Natural Bridge in Powell County (Taylor 35) 1925.—*Me.* Pleasant Ridge in Somerset County (Chamberlain 3305) 1916.—*Mass.* Worcester (Greenwood) 1910.—*Mich.* Superior (Nichols & Steere) 1925.—*Minn.* Oneates near Duluth (Conklin) 1907.—*Mont.* Polson (Frye) 1928.—*N. C.* Durham (Blomquist) 1931.—*N. J.* Highlands (Haynes) 1905.—*N. H.* Franconia Mts. (Evans) 1908.—*N. Y.* Warren (Burnham) 1918.—*Ohio.* Whites Gulch in Jackson County (Taylor) 1925.—*Pa.* State College (Roberts) 1924.—*Vt.* Newfane (Grout) 1904.—*Wash.* Friday Harbor (Clark) 1925.—*Wis.* Brule River in Douglas County (Conklin) 1923.

TYPE LOCALITY: European.

RANGE: Labrador (212), Miquelon Isl. (431), N. S. (53.2), N. B. (373), Me. (365.1), N. H. (359), Vt. (141), Mass. (232), R. I. (203), Conn. (140), N. Y. (58), Que. (178), Pa. (237), Ohio, Ont. (373), Ind. (212), Mich. (331.1), Ill. (246.7), Wis. (94.1), Minn. (94.1), Utah (214.1), Ida. (80.1), Mont. (81), Alaska (135), B. C. (390), Wash. (218.1), Ore. (239), Cal. (84.1), Tenn. (3.1), N. C. (43), Ky. (218.2), W. Va. (8), N. J. (212); Asia (103.3); Eur. (226); Canary Isls. (409).

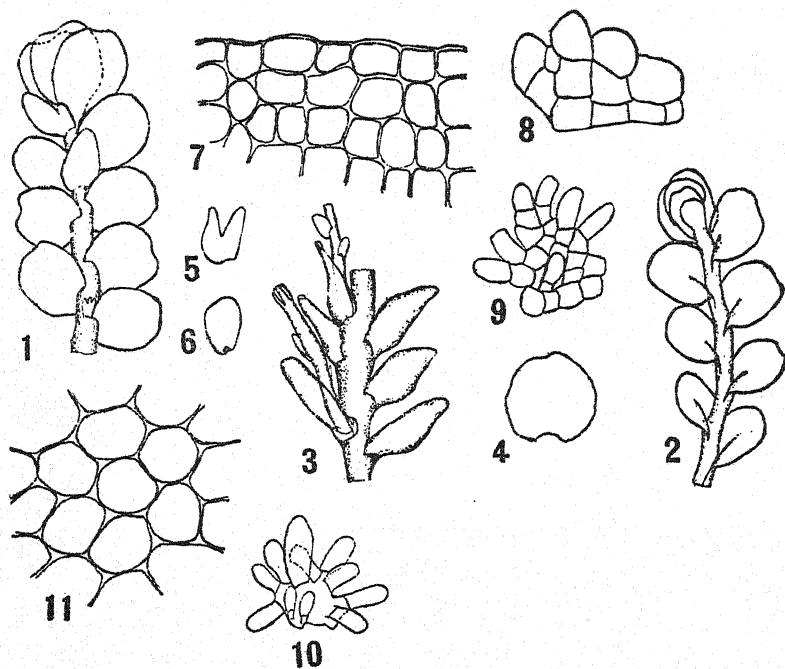
While Linne published the name *Jungermannia lanceolata* (Sp. Pl. 1131, 1753) it was founded upon a mixture of several species, and fitted none of them completely. Thus there is doubt as to just which species as we now know them should take the Linnean name, if any should. Many authors therefore disregard the Linnean report of a species *J. lanceolata*, and base the name on Schrader's material gathered in Germany (Sammlung, Liefg. 2:4, 1797), although it is clear that it is not any of the plants in the package from which Linne wrote his description. Naturally various plants were called *J. lanceolata* by various authors, confusing the synonymy. We follow the usual usage in basing the name on Schrader's collection, although we believe that a species name other than *lanceolata* would have been a wiser selection.

2. *Jungermannia allenii*<sup>102</sup> Clark, Bull. Torr. Bot. Club 36:303, 1909.

*Aploxia allenii* Clark & Frye, Publ. Puget Sound Biol. Sta. 6:68, 1928.

Plants in tufts or patches, brownish green to reddish. Stems 1.5-3 cm long, 150-250  $\mu$  thick, ascending to suberect, sparingly branched, the branches arising from the ventral part of the leaf axil. Rhizoids few or

<sup>102</sup> ál læn' i f.



*Jungermannia allenii*. 1, Tip of shoot, ventral view, showing one under-leaf,  $\times 15$ . 2, Tip of shoot, dorsal view,  $\times 15$ . 3, Piece of stem with two branches,  $\times 15$ . 4, Leaf,  $\times 15$ . 5-6, Underleaves,  $\times 140$ . 7, Cells along leaf margin,  $\times 240$ . 8, Small underleaf,  $\times 240$ . 9-10, Underleaves bearing papillae,  $\times 140$ . 11, Cells of the leaf middle,  $\times 240$ . (All after Clark & Frye.)

none, colorless. Leaves alternate, succubous, with slightly decurrent dorsal margin, distant to somewhat overlapping, spreading, not or hardly 2-lobed, oval to subrotund, concave, 1-1.4 mm long, 0.8-1.35 mm wide; apex rounded to retuse; margin entire, with a border of more deeply pigmented cells. Cells of the leaf middle 20-30  $\mu$ ; walls thin; trigones large and distinct; cuticle striolate. Gemmae unknown. Underleaves minute and fugaceous, sometimes large and persistent, mostly 20-40  $\mu$  long and bearing numerous hyaline papillae, occasionally up to 1 mm long, undivided to 2-parted. Plants unisexual (with some question). Inflorescences largely unknown, the sporophyte wholly so. Named in honor of Dr. O. D. Allen, who first collected it.—On rocks more or less submerged.

ILLUSTRATIONS: Clark, Bull. Torr. Bot. Club 36: pl. 36, figs. 1-11, 1909; Clark & Frye (81) 6:69, figs. 1-11.

EXAMINATIONS: Type material.

TYPE LOCALITY: Paradise Valley on Mt. Rainier, Washington, U.S.A. (Dr. O. D. Allen).

RANGE: Wash. (80), B. C. (157).

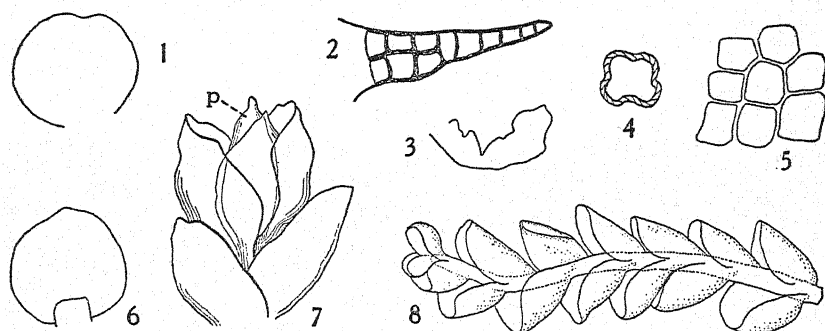


3. *Jungermannia pendletonii*<sup>103</sup> (Pears.) Evans, Proc. California Acad. Sci., Ser. 4, 13:122, 1923.

*J. cordifolia* of Haynes Amer. Hep. Exsic. No. 90, about 1911. Not of Hook. Brit. Jung. pl. 32, 1816.

*Aplozia pendletonii* Pears., Bryologist 23:50, 1920.

Plants in lax tufts or patches, dark green, often tinged with purple or brown to red, often blackish in drying. Stems 2.5-3 cm long, without flagella, with occasional terminal and also intercalary branches, the latter arising in the ventral portion of the leaf axil. Rhizoids few, short, discolored. Leaves alternate, succubous, somewhat distant below, subimbricate above, spreading to suberect, subsecund, not or barely simply bilobed, orbicular, flaccid, clasping and partly concealing the stem, 2 cells



*Jungermannia pendletonii*. 1, Leaf, x12.7. 2, Cross section of leaf, x79. 3, Part of mouth of perianth, x26. 4, Cross section of perianth, x25. 5, Leaf cells, x154. 6, Leaf, x12.7. 7, Tip of shoot with perianth (p), x14. 8, Sterile shoot, x8.5. (1-6, 8, after Pearson; 7, original, by Elizabeth Curtis.)

thick at base, 1.1-1.6 mm long, 1.3-1.7 mm wide, not tapering toward tip; margin entire; apex broadly rounded to emarginate; lobes rounded; sinus wide and shallow. Cells of leaf middle mostly 40-50  $\mu$  long and 25-30  $\mu$  wide, of the margin mostly 27-32  $\mu$ , 4-6-angled; walls thin; trigones none or usually small but distinct near the margin; cuticle smooth to very indistinctly striolate. Underleaves wanting. Male plants unknown. Female bracts similar to the leaves, about 1.25 by 0.5 mm. Perianth very small, slightly exceeding half the length of the bracts, immersed, about 750  $\mu$  long and 500  $\mu$  thick, obovate, free from the bracts, the upper part obtusely 4-5-plicate, the lower part 2 cells thick; mouth constricted, very small, entire. Sporophyte unknown. Named after George M. Pendleton, who first found it.—In slowly running water.

<sup>103</sup> pên dẻl tẻn' i l.

ILLUSTRATIONS: Pearson, Bryologist 23: pl. 2, 1920; also 23:85, figs. 1-3, 1920.

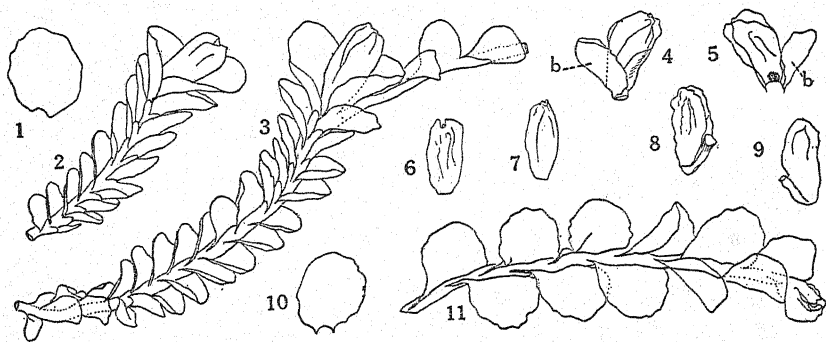
EXAMINATIONS: Cal. Sisson, now Shasta City (Pendleton) 1910.

TYPE LOCALITY: Western side of Mount Shasta, California, at 4000 feet (G. M. Pendleton) Aug. 4, 1917. His first collection of it was in 1910.

RANGE: Known only from the type locality.

4. *Jungermannia bolanderi*<sup>104</sup> Underw. Bot. Gaz. 13:113, 1888.

Plants sometimes in patches, very light green, the leafy shoots 200-350  $\mu$  wide. Stems 2-3 cm long, prostrate or ascending, simple or with occasional lateral branches, sometimes innovating below the female bracts. Rhizoids very few, colorless or slightly yellowish. Leaves alternate, succubous, very obliquely to almost longitudinally inserted, dorsally strongly decurrent especially on sterile stems, distant below, somewhat imbricate above on fertile shoots, horizontally spreading, not lobed, orbicular to ovate, 0.8-1.5 mm long, 0.7-1.8 mm wide, usually longer than wide, usually widest just below the middle, somewhat concave dorsally, or on sterile stems plane, rather hyaline, rather flaccid; apex rounded; margin entire



*Jungermannia bolanderi*. 1, Female bract,  $\times 7.2$ . 2-3, Shoots with perianth, dorsal view,  $\times 7.2$ . 4-9, Perianths, some subtended by female bract (b),  $\times 7.2$ . 10, Female bract,  $\times 7.2$ . 11, Innovation from beneath perianth,  $\times 7.2$ . (All after Underwood.)

to slightly sinuate, the dorsal slightly inflexed on fertile shoots. Cells of leaf middle 25-40  $\mu$ , those of the margin about the same, of the base 45-96  $\mu$  long; walls thin; trigones not or barely present; cuticle smooth or slightly rough. Underleaves wanting. Plants unisexual (with some doubt). Male inflorescence about the middle of the shoot; male bracts 6-8, transversely inserted, ventricose at base; antheridia few. Female bracts larger but a gradation from the upper leaves, free from the perianth, the larger about twice the area of the foliage leaves, more concave, more nearly transversely inserted, similar to the leaves in form. Perianth

<sup>104</sup> bô lăn' dẻ i.

cylindrical-obovoid, with 3-5 irregular obtuse ridges, when young abruptly contracted to the mouth; mouth small, somewhat beaked, subentire to slightly denticulate. Sporophyte unknown. Named in honor of Dr. Henry N. Bolander, who first found it.—In ditches.

ILLUSTRATIONS: Underwood, Bot. Gaz. 13: pl. 5, 1888.

EXAMINATIONS: None.

TYPE LOCALITY: Mt. Dana, California, at 3100 meters (Bolander) September, 1866.

RANGE: Known only from the type locality (296).

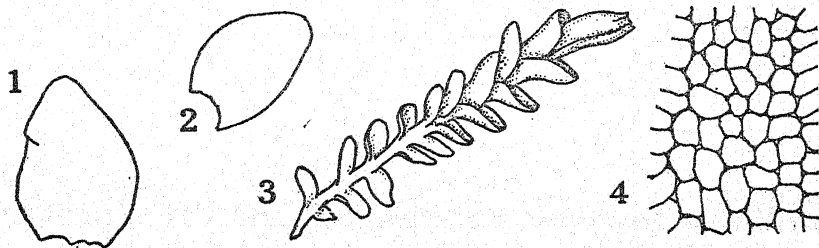
5. *Jungermannia oblongifolia*<sup>105</sup> (K. Muell.) Buch, Evans & Verdoorn, Ann. Bryol. 10 (1937): 4, 1938.

*Haplozia oblongifolia* K. Muell., Rabenh. Krypt.-Fl. 6(1): 558, 1909.

*Haplozia cordifolia* var. *sibirica* Arn. & Jens., Ark. Bot. K. Svenska Vetensk. 13(2): 19, 1913.

*Aplozia oblongifolia* Joerg., Bergens Mus. Skrift. 16: 109, 1934.

Plants in patches, filiform, black; leafy shoots 0.5-1 mm wide. Stem 10-15 mm long, prostrate, usually with several innovations under the perianth. Rhizoids rather numerous, often quite to the tip of the stem, hyaline or brownish. Leaves alternate, succubous, not decurrent, distant to overlapping, spreading to erect-spreading, secund, unlobed, broadly oval, widest in the middle or slightly below it but never cordate, narrowed toward base, thin, more or less saccate, up to 1 mm long and 800  $\mu$  wide; apex rounded; margin entire. Cells of the middle of the leaf 18-20 by 30-40  $\mu$ , of the margin about 15-17  $\mu$ , of the base about 18 by 48  $\mu$ ; walls thin; trigones none to small and indistinct; cuticle smooth. Underleaves wanting. Plants unisexual. Male plants unknown. Female bracts like the leaves. Perianth fusiform, free from the bracts, when mature club-shaped, gradually somewhat contracted at apex, probably plicate (see note after "Range"); mouth not tubular, crenulate by projecting cells,



*Jungermannia oblongifolia*. 1, Female bract, x 10.6. 2, Leaf, x 10.6. 3, Shoot, dorsal view, x 10.6. 4, Leaf cells, x 180. (All after K. Mueller.)

<sup>105</sup> öb löñ" ji fō' li ä.

its cells about 18 by 24  $\mu$ . Elaters attenuate at both ends; spirals 2, yellowish. Spores 21-30  $\mu$ , granulate, golden brown. Name from *L. oblongus*, rather long, and *folius*, leaf; in reference to the form of the leaf.—In moist shady places.

ILLUSTRATIONS: K. Mueller (409) 2: fig. 202.

EXAMINATIONS: None.

TYPE LOCALITY: Greenland (Dr. J. Vahl) 1829.

RANGE: Greenland (431); Asia (325); Eur. (325).

According to Joergensen (325) it may be only a variety of *J. cordifolia*. The smaller and more keeled leaves as well as the unplicate perianth of *J. oblongifolia* distinguish it from *J. atrovirens*.

While the perianth is described as not plicate, K. Mueller (409) figures it with plicae close to the mouth, with a dorsal one running at least three-fourths to the base.

6. *Jungermannia cordifolia*<sup>106</sup> Hook. Brit. Jung. pl. 32, 1816. Not of Mart. Fl. Crypt. Erlangensis 183, 1817; not of Hueben. Hep. Germ. 90, 1834.

*Aplozia cordifolia* Dum. Hep. Eur. 59, 1874.

*Solenostoma cordifolia*<sup>107</sup> Steph., Bull. Herb. Boissier, Ser. 2, 1:499, 1901; also Sp. Hep. 2:61, 1901.

*Haplozia cordifolia* K. Muell., Rabenh. Krypt.-Fl. 6(1):554, 1909.

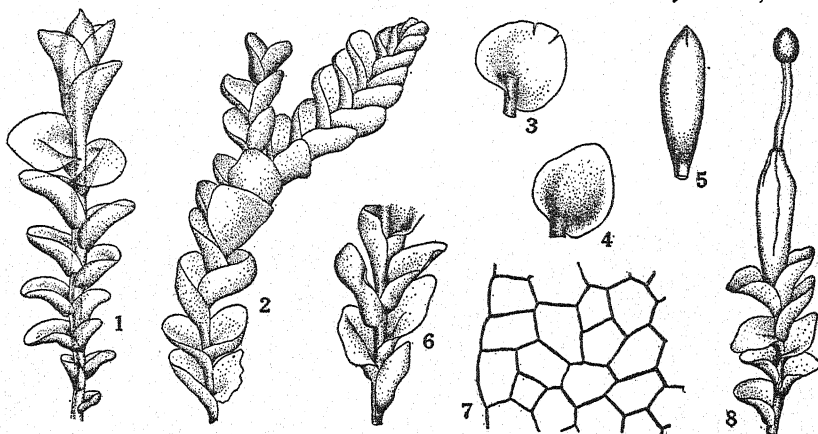
Plants in large spongy tufts or patches, purplish black to sometimes olive green; leafy shoots 2-4 mm wide. Stems up to 12 cm long, erect to suberect, flexuose, simple or branched, at least occasional branches arising from the ventral part of a leaf axil, often stoloniferous at base; the stolons 3-12 cm long, at base leafless and with hyaline rhizoids; flagella at least often wanting. Rhizoids few, almost none on upper part of stem, colorless to brown. Leaves alternate, nearly transverse or barely succubous in insertion, very little decurrent at dorsal margin, distant on lower part of stem, subimbricate to approximate on upper, erect to spreading, not lobed, ovate with rounded or somewhat cordate base, widest near base and tapering gradually to near apex, nearly to quite as wide as long, about 1.8 mm, flaccid, concave, embracing the stem and partly concealing it, with narrow region of attachment; apex rounded; margin entire. Cells of leaf middle mostly 40-45  $\mu$  long and 20-30  $\mu$  wide, of margin mostly about 20-23  $\mu$ , of base 20-25 by 50-80  $\mu$ , 4-6-angled; walls thin, usually reddish brown; trigones wanting or occasional ones near margin barely present; cuticle smooth to usually finely striate-verruculose. Underleaves wanting. Plants unisexual. Male plants in separate tufts or with the female; smaller, more slender, their leaves more distant, somewhat saccate at base; male bracts 20-24, imbricate, erect, concave, saccate; an-

<sup>106</sup> *kór di fō' li ä.*

<sup>107</sup> Written *cordifolium* by some later authors to agree in gender with the genus *Solenostoma*.



theridia usually 1, oval-globose, with short stalk. Female bracts like the leaves or sometimes smaller, usually longer than wide, often revolute at margin. Perianth  $\frac{1}{3}$ – $\frac{1}{2}$ -emergent, fusiform, slightly dorsiventrally compressed, slightly plicate at apex but otherwise smooth, gradually narrowed to the mouth, reddish; mouth crenulate at first with projecting cells and later with 5-6 short teeth; cells of the mouth about  $18\ \mu$ , of the base about 20 by  $75\ \mu$ . Sporangium oval-oblong, brown to purplish black; epidermal cells quadrate, much larger than those of the inner layer, with nodular thickenings; inner layer of cells of the wall very small, with



*Jungermannia cordifolia*. 1, Shoot with young perianth, x 6.6. 2, Sterile plant, x 3.8. 3, Flattened leaf, x 5.1. 4, Flattened leaf, x 6.8. 5, Perianth, x 4.7. 6, Part of male inflorescence, x 5.1. 7, Median leaf cells, x 285. 8, Shoot with perianth and sporophyte, x 2.5. (1, 4-5, after Pearson; 7, original; the others after K. Mueller.)

semiannular thickenings. Elaters 100-150  $\mu$  long, about 8  $\mu$  wide, slightly attenuate at one end; spirals 2; wide, not very closely wound, reddish brown. Spores 18-24  $\mu$ , finely granulate, yellowish brown. Name from *L. cordis*, of a heart, and *folium*, leaf; in reference to the cordate-ovate leaves.—On wet rock in streamlets, on wet soil; in mountains.

ILLUSTRATIONS: Pearson (433) 2: pl. 122; Hooker (285) pl. 32; Ekart (124) pl. 3, fig. 26; K. Mueller (409) 1: fig. 280; Macvicar (374) 146, figs. 1-4; Gil (76) figs. 216-217; Meylan (386) fig. 82.

EXAMINATIONS: *Alaska*. Port San Antonio (Frye) 1913.—*Alta*. Healy Creek (Brinkman 941) 1918.—*B. C.* Monarch Mt. (Brinkman 917) 1913.—*Cal.* Sisson (Pendleton) 1918.—*Conn.* Hartford (Conklin 2394) 1924.—*Ida.* Trude (Miller) 1934.—*Me.* Oxford (Greenwood 269) 1930.—*Mass.* Topsfield (Elizabeth Young) 1934.—*Mont.* Many Glaciers in Glacier National Park (Frye) 1928.—*N. H.* Waterville (Lorenz) 1907.—*N. S.* Indian Brook (Nichols) 1900.—*Ore.* Mt. Hood (Frye) 1907.—*Vt.* Hartland (Lorenz) 1921.—*Wash.* Elwha River valley in Olympic Mts. (Frye) 1907; Mt. Rainier National Park (Svihla 317) 1931.—*Wis.* Ashland (Cheney) 1896.—*Wyo.* Libby (Porter 1603) 1934; Yellowstone National Park (Frye) 1934.

TYPE LOCALITY: Highland Mountains of Scotland (Dickson).

RANGE: Greenland (504), Labrador (510), Anticosti (373), N. S. (53.2), Me. (366), N. H. (155), Vt. (200), Mass., Conn. (212), N. Y. (418), Que. (178), Ont. (431), Mich. (483), Wis., Colo. (175), Wyo. (445), Mont. (328), Alta. (46.2), Yukon (298), Alaska (454), B. C. (247.1), Ida., Wash. (218.1), Ore. (216.1), Cal.; S. Amer. (458); Asia (325); Eur. (329); Iceland (350.1).

7. *Jungermannia pumila*<sup>108</sup> With. Bot. Arr. Veg. Brit. 3:866, 1776.

*Gymnoscyphus repens* Corda in Sturm, Deutschl. Fl. 2:158, pl. 42, 1832.

*J. zeyheri* Hueben. Hep. Germ. 89, 1834.

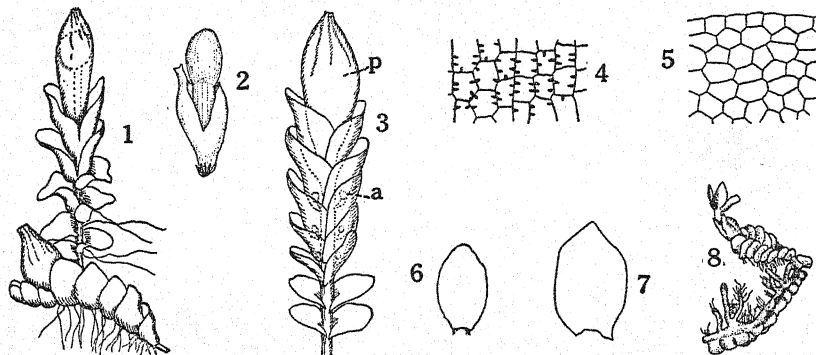
*J. rostellata* Hueben. Hep. Germ. 95, 1834.

*Aplozia rostellata* Dum. Hep. Eur. 58, 1874.

*Aplozia pumila* Dum. Hep. Eur. 59, 1874.

*Haplozia pumila* K. Muell., Rabenh. Krypt.-Fl. 6(1):567, 1909.

Plants in depressed patches, olive green to nearly black, small; leafy shoots up to 1.3 mm wide. Stems 5-10 mm long, ascending to suberect from a creeping base, simple or branched, frequently innovating below the female inflorescence, with none or few stolons. Rhizoids numerous to near apex of stem, hyaline to brownish. Leaves alternate, succubous, the dorsal margin somewhat decurrent, rather distant but somewhat im-



*Jungermannia pumila*. 1, Part of plant with perianth,  $\times 8$ . 2, Perianth and young sporophyte,  $\times$  about 7. 3, Part of plant with antheridia (*a*) and perianth (*p*),  $\times 10.6$ . 4, Epidermal cells of a sporangium,  $\times 132$ . 5, Cells along the leaf margin,  $\times 132$ . 6-7, Leaves when flattened out,  $\times 10.6$ . 8, Plant showing a number of flagella,  $\times$  about 4. (2, after Hooker; 5, after Gil; 8, after Lotsy; the others after K. Mueller.)

bricate at tip of stem, obliquely spreading to nearly horizontal, unlobed, the lower oval, the upper ovate-oval; apex rounded; margin entire. Cells of the leaf middle 20-35  $\mu$ , 5-6-angled; those of the margin about 12  $\mu$ , quadrate, in size like those of the second row; cell walls thin; trigones small and distinct to none; oil bodies wanting or minute; cuticle striate-verruculose. Underleaves wanting. Plants bisexual. Male bracts just

<sup>108</sup> pū' mī lā.

beneath the female ones, 6, concave, broadly ovate; antheridia usually 1, oval-globose, with very short stalk. Female bracts larger than the leaves but a gradation from them, erect with the upper part patent to squarrose, succubous but nearly transversely inserted, clasping the stem, ovate, concave with saccate base. Perianth fusiform, free from the bracts, nearly smooth, slightly dorsi-ventrally compressed, slightly plicate only near the tip, apex acute; cuticle striate-verruculose; trigones distinct; mouth crenulate with elongate cells. Seta 2-3 mm long. Sporangium oval, dark brown; epidermal cells about 20  $\mu$  wide, quadratic, with two nodular thickenings on the longitudinal walls and 0-1 on the transverse walls; inner wall cells about 10  $\mu$  wide but elongate, with semiannular thickenings. Elaters 6-7  $\mu$  wide, slightly attenuate; spirals 2, wide, reddish brown. Spores 15-24  $\mu$ , finely granulate, brownish yellow. Name the *L. pumilus*, a dwarf; referring to the size of the plant.—On wet rocks and damp gravelly soil.

ILLUSTRATIONS: Hooker (285) pl. 17; Pearson (433) 2: pl. 123; K. Mueller (409) 1: fig. 284; Ekart (124) pl. 2, fig. 13; Macvicar (374) 150, figs. 1-4; Gil (76) fig. 221; Meylan (386) fig. 85A; Steere (485.5) 74, figs. 1-2; Ammons (3.1) 140, fig. E; Schiffner, Hedwigia 48: 185, figs. 14-16, 1908.

EXAMINATIONS: *B. C.* Shushwap Lake (Brinkman) 1909.—*Conn.* Hamden (Nichols) 1907.—*Ky.* Natural Bridge (Taylor) 1925.—*Me.* Seal Harbor (Lorenz) 1922.—*Mass.* Worcester (Greenwood) 1914.—*Mich.* Tahquamenon Falls in Luce County (Nichols) 1933.—*Minn.* West Duluth (Conklin 1577) 1911.—*N. H.* Waterville (Lorenz) 1911.—*N. S.* St. Croix (Brown 274) 1923.—*Ohio.* Hocking County (Taylor) 1922.—*Pa.* Fair Grounds in Bedford County (Lanfear) 1931.—*W. Va.* Durbin (Sheldon) 1909.—*Wis.* Bayfield County (Conklin) 1922; Black River in Douglas County (Conklin) 1922.

TYPE LOCALITY: "Cwm Idwel" (Griffith), evidently in Wales.

RANGE: Greenland (320), Ellesmere Isl. (56.01), N. S. (53.2), Me. (369.1), N. H. (359), Mass. (169), R. I. (169), Conn. (212), Vt. (241), Que. (178), Pa. (237), Ont. (373), Ohio, Mich. (213), Wis. (98), Minn. (94.1), Alta. (46.2), B. C. (296), Colo. (175), Cal. (296), Tenn. (3.1), N. C. (12), Ky. (218.2), W. Va. (468), Md. (212), D. C. (282), N. J. (506); Asia (325); Eur. (433); Iceland (3.1).

7a. *Jungermannia pumila* var. *rivularis*<sup>109</sup> (K. Muell.) n. comb.

*Aplozia pumila* var. *rivularis* Schiffn., Lotos 48:326, 1900.

*Haplozia pumila* var. *rivularis* K. Muell., Rabenh. Krypt.-Fl. 6(1):568, 1909.

*Aplozia rivularis* Schiffn., Lotos 59:2, 1911.

Plants aquatic or subaquatic, several times as large as the type; leafy shoots up to 2 mm wide. Stems up to 1.5 cm long, often stoloniferous. Leaf cells rather larger than in the type, the median ones 20-40  $\mu$ , the marginal ones about 20  $\mu$ . Perianth considerably larger than in the type, cylindrical to clavate, more distinctly plicate toward the apex than in the type. Name *L. rivularis*, pertaining to a small stream; in reference to its wetter habitat.—On wet rocks or wet soil.

<sup>109</sup> rīv ū lā' rīs.

ILLUSTRATIONS: None.

EXAMINATIONS: None.

TYPE LOCALITY: Zwickau near Roehrsdorf, Czechoslovakia.

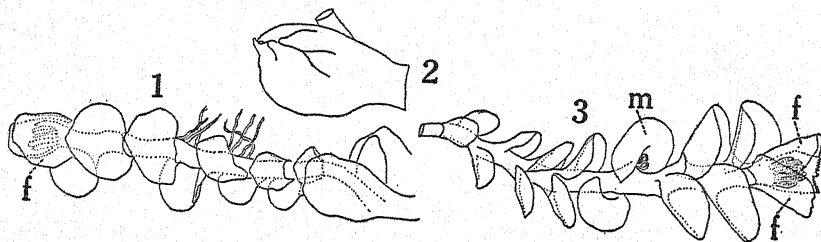
RANGE: New England (94.3); Wis. (98); Eur. (409).

We do not know on what collection its occurrence in "New England" is based. It seems clear however that a statement of the differences may bring to light other North American discoveries of the variety, which would probably clarify the relation of the variety to the type. It may be merely a form due to very wet habitat.

8. *Jungermannia danicola*<sup>110</sup> Underw., Bot. Gaz. 13:113, 1888.

*Solenostoma danicola* Steph., Bull. Herb. Boissier, Ser. 2, 1:491, 1901; also Sp. Hep. 2:53, 1901.

Plants in dense patches, fuscous brown, somewhat blackish when dry. Stems 5-10 mm long, 180-360  $\mu$  thick, or of attenuate branches only 80-100  $\mu$  thick, ascending, simple or with few branches, sometimes innovating near base of perianth. Rhizoids sparing to moderate in number, often wanting on upper part of the stem and on innovations, long, hyaline to tawny. Leaves alternate, transversely inserted, decurrent, distant to contiguous on lower stem, slightly overlapping and larger on upper part, spreading to horizontally spreading, embracing more than half the stem,



*Jungermannia danicola*. 1, Side view of shoot with archegonia at tip (f), female bract; the perianth not shown, x22. 2, Female tip with somewhat 2-lipped perianth, not clear in form, x22. 3, Part of shoot with archegonia at tip within perianth (not shown 2-lipped), and female bracts (f); male bract (m) about middle, x22. (All after Underwood.)

unlobed, concave; on sterile stems broadly ovate to orbicular; on fertile stems broadly orbicular to subreniform, 500-900  $\mu$  long, 0.6-1.2 mm wide, larger than those of the sterile stems; apex rounded; margin entire. Cells of leaf middle 24-50  $\mu$ , of the margin slightly smaller but similar in form, of the base about twice as long; walls thin between trigones; trigones small; oil bodies few; cuticle nearly smooth to very minutely hyaline-papillate. Underleaves wanting. Plants bisexual. Male bracts somewhat remote from the female ones on the same stems, hardly different from the

<sup>110</sup> dā nī' kō lā.



foliage leaves; antheridia 2, shortly stalked. Female bracts similar to the foliage leaves, inserted above the base of the perianth, more erect, much larger, the dorsal margin recurved. Perianth free from the bracts or nearly so, most of its length emergent, obovoid when mature, irregularly 4-plicate toward the tip, rather abruptly contracted to mouth; the ridges low, obtuse; mouth slightly beaked, at first crenulate-denticulate, the condition when old not known. Sporophyte unknown. The name from Mt. Dana in California, and *L. cola*, inhabiting; because it was first found there.—In ditches.

ILLUSTRATIONS: Underwood, Bot. Gaz. 13: pl. 3, 1888.

EXAMINATIONS: None.

TYPE LOCALITY: Mt. Dana, California, at 3100 meters (Dr. Henry N. Bolander) September, 1866.

RANGE: Known only from the type locality.

The best account of this species is by Howe (296).

9. *Jungermannia schiffneri*<sup>111</sup> (Loitl.) Evans, Bryologist 20:21, 1917.

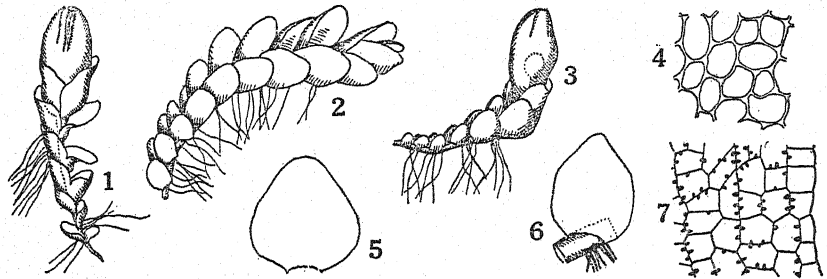
*Aplogia schiffneri* Loitl., Verh. Zool.-Bot. Gesell. Wien 55:482, 1905.

*Haplogia schiffneri* K. Muell., Rabenh. Krypt.-Fl. 6(1):570, 1909.

Plants in small compact depressed dark green patches. Stems 6-10 mm long, prostrate with ascending tips, simple or slightly branched but often with innovations. Rhizoids numerous to near tip of stem, long, hyaline. Leaves alternate, succubous, not decurrent, contiguous to somewhat imbricate, erect-spreading, curved toward the dorsal side of the plant, not lobed, roundish ovate to broadly cordate, about 450  $\mu$  long and 400  $\mu$  wide; apex rounded; margin entire. Cells of leaf middle 14-25  $\mu$ , 5-6-angled; of the margin 10-12  $\mu$ , about the same size as those of the second row; walls thin; trigones minute; oil bodies minute, spherical; cuticle finely striate-verruculose or smooth. Underleaves wanting. Plants bisexual. Male bracts below the female ones, 6-8, concave-saccate. Female bracts similar to the leaves, larger but grading into them, somewhat embracing the perianth, their upper third often spreading, concave. Perianth ovoid to oblong-ovoid, becoming cylindrical-clavate and widest slightly above the middle, free from the bracts,  $\frac{1}{2}$ - $\frac{2}{3}$ -emergent, rounded at apex, suddenly contracted to the mouth, somewhat dorsi-ventrally compressed, slightly plicate in the upper third; mouth without tube, crenulate to crenulate-dentate by projecting cells. Seta about 5 mm long. Sporangium almost spherical, dark brown; epidermal cells 12-14  $\mu$ , considerably irregular in form, usually with 2-4 nodular thickenings on each longitudinal

<sup>111</sup> shif' nēr i.

wall, usually only 2 distinct ones on each transverse wall separating two cells, but 0-1 on each of 2 transverse walls joining the same cell; cells of inner wall layer about  $10\ \mu$  wide, elongate, with semiannular thickenings. Elaters up to  $100\ \mu$  long,  $7-8\ \mu$  thick; spirals 2, reddish brown. Spores



*Jungermannia schiffneri*. 1, Shoot with perianth,  $\times 10.6$ . 2, Sterile shoot,  $\times 13$ . 3, Shoot with perianth,  $\times 10.6$ . 4, Median leaf cells,  $\times 290$ . 5-6, Leaves when flattened out,  $\times 21$ . 7, Epidermal cells of the sporangium,  $\times 290$ . (All after K. Mueller.)

$15-18\ \mu$ , finely granulate, yellowish brown. Named in honor of Dr. Victor Schiffner of the University of Praha, Czechoslovakia, who in 1899 in the Austrian Tyrol made the earliest collection of this plant.—On damp soil and in crevices of rocks.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 285; Macvicar (374) 152, figs. 1-6; Schiffner, *Hedwigia* 48:185, figs. 1-13, 1908.

EXAMINATIONS: B. C. Monarch Mt. (Brinkman) 1913; Stephen (Brinkman) 1913.—Minn. Grant Moraine in Cook County (Conklin 3010) 1926; Duluth (Conklin 2052) 1911.—Wis. Bark Point in Bayfield County (Conklin 1852) 1922; Monahan Falls in Douglas County (Conklin 1590) 1912.

TYPE LOCALITY: Along Paradana Street in Gorizia, Italy (Loitlesberger) 1903.

RANGE: Ellesmere Isl. (325), Que. (522.1), Pa. (338), Mich. (485.1), Wis. (98), Minn. (95), Alta.? (46.2), B. C. (267); Eur. (409).

#### 10. *Jungermannia atrovirens*<sup>112</sup> Dum. Syll. Jung. Eur. 51, 1831.

*Aplozia polaris*<sup>118</sup> Lindb., Oefv. Kgl. Vet.-Akad. Foerh. 23:560, 1867.

*Aplozia atrovirens* Dum. Hep. Eur. 63, 1874.

*J. pumila* var. *polaris*<sup>113</sup> Bergg., Kgl. Svenska Vet.-Akad. Handl. 13(7):98, 1875.

*Aplozia atrovirens* var. *schleicheri* Bernet Cat. Hep. Suisse 60, 1888.

*J. polaris*<sup>113</sup> Lindb. According to Steph. Sp. Hep. 2:81, 1901.

*Haplozia atrovirens* K. Muell., Rabenh. Krypt.-Fl. 6(1):563, 1909.

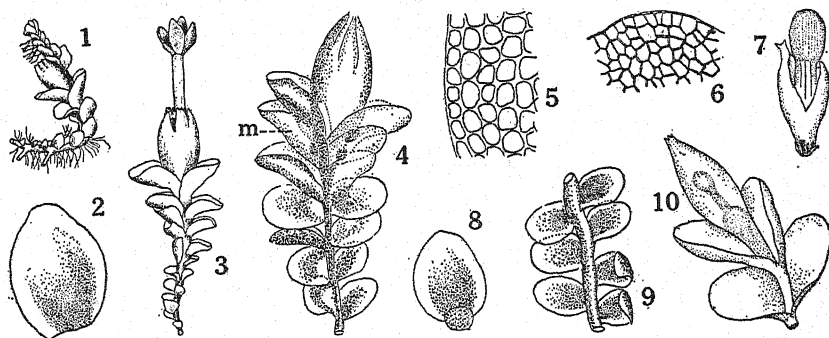
*Haplozia polaris*<sup>113</sup> K. Muell., Rabenh. Krypt.-Fl. 6(1):566, 1909.

Plants in mats, olive green or sometimes yellowish green, minute. Stem 2-6 mm long, ascending to suberect from a creeping base, slightly

<sup>112</sup> ät rö vi' rëns.

<sup>113</sup> We follow Stephani, Bull. Herb. Boissier, Ser. 2, 1:519, 1901; also Sp. Hep. 2:81, 1901, with considerable misgiving, in referring this plant to *A. atrovirens*, not having access to specimens of undoubted authenticity.

branched, often innovating with several stolons beneath the perianth from the ventral part of the leaf axil. Rhizoids numerous to near tip of stem, hyaline to brownish. Leaves alternate, succubous on lower part of stem, almost transversely inserted on upper part, not decurrent, imbricate,



*Jungermannia atrovirens*. 1, Plant with perianth, x 8.5. 2, Female bract, x 13.7. 3, Plant with sporophyte, x 8.5. 4, Shoot with perianth and male bracts (*m*), x 13.7. 5, Cells along leaf margin, x 132. 6, Leaf cells, x 106. 7, Calyptra and immature sporophyte, x about 32. 8, Leaf, x 13.7. 9, Part of leafy shoot, dorsal view, x 13.7. 10, Tip of shoot with perianth, x about 9. (1, 3, 6, after K. Mueller; 2, 4, 8-9, after Pearson; 5, after Gil; 7-10, after Hooker.)

spreading to erect, the upper ones about half embracing the stem, not lobed, concave, oval or ovate, 350-950  $\mu$  long, 250-800  $\mu$  wide, widest near their base; apex rounded; margin entire. Cells of leaf middle 20-35  $\mu$ , of the margin 12-15  $\mu$ , of the base 20-45  $\mu$ , 4-6-angled; walls slightly thickened, deeply pigmented; trigones usually distinct; oil bodies very small, about the size of the chloroplasts; cuticle striate-verruculose. Underleaves wanting. Plants unisexual. Male plants more delicate, in separate tufts or intermingled with the female ones; male bracts 12-16, either near the middle or at the tip of the stem, imbricate, erect with the tip widely spreading, saccate, concave to apex; antheridia 1-2, short stalked. Female bracts oval, larger than the leaves, about half embracing the stem, erect to somewhat spreading; bracteole wanting. Perianth  $\frac{1}{2}$ - $\frac{2}{3}$ -emergent, slightly dorsiventrally compressed, often apparently lateral through rejuvenation of the stem tip, ovoid to oblong-ovoid, free from the bracts, smooth below, toward tip slightly to deeply 5-plicate and acutely narrowed; mouth contracted, not or barely tubular, shortly 5-lobed and finely lacinate; cells like those of the leaves, at the mouth about 15 by 20  $\mu$ . Seta 2-5 mm long. Sporangium oval-oblong, purplish brown; epidermal cells with nodular thickenings; inner layer of wall cells larger than the epidermal cells, with spiral thickenings. Elaters about 100  $\mu$  long and 8  $\mu$  wide, gradually attenuate at both ends; spirals 2 or rarely 1, very

closely coiled, reddish brown. Spores 10-17  $\mu$ , finely granulate, reddish brown. Name from *L. atrox*, gloomy, and *virens*, green; in reference to the olive green color of the plant.—On wet and often calcareous rocks.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 283, a-c, e, g; Macvicar (374) 149, figs. 1-4; Gil (76) fig. 220; Meylan (386) fig. 84.

EXAMINATIONS: B. C. Golden (Brinkman) 1923; Hector (Brinkman) 1912; Mt. Queest (Macoun 100) 1889; Shawnigan Lake (Macoun 61) 1893; Shushwap Lake (Conklin) 1909.—*Colo.* Silverton (Frye) 1931.—*Ida.* Knox (Frye) 1929.—*Mont.* Glacier National Park (Frye) 1929; Medicine Hot Springs (Frye) 1929.—*Ore.* Silver Creek in Marion County (Foster) 1910.—*Wash.* Aberdeen (Foster) 1909; Elwha River valley in Olympic Mts. (Svihla 224) 1931; Seattle (Frye) 1906.

TYPE LOCALITY: Above Lausanne, Switzerland (Schleicher).

RANGE: Greenland (320), Ellesmere Isl. (56.01), *Colo.*, *Mont.* (84.2), *Alta.* (42.6), *Alaska* (136), B. C. (247.1), *Ida.* (82), *Wash.* (81), *Ore.*; *Asia* (491); *Eur.* (119); *Spitzbergen* (56.01).

# 11. *Jungermannia tristis*<sup>114</sup> Nees Naturg. Eur. Leberm. 2:461, 1836.

*J. cordifolia* var. *nudifolia* Nees Naturg. Eur. Leberm. 3:536, 1838.

*J. riparia* Tayl., Ann. Mag. Nat. Hist. 12:88, 1843.

*J. potamophila* Mueller-Arg., Mougeot Nestler & Schimp. Sturp. Crypt. Vageso-Rhenanae Exsic. No. 1418 (about 1853), according to K. Mueller in Rabenh. Krypt.-Fl. 6(1):559, 1909.

*Aplozia tristis* Dum. Hep. Eur. 63, 1874.

*Aplozia riparia* Dum. Hep. Eur. 63, 1874.

*J. riparia* var. *potamophila* Bernet Cat. Hep. Suisse 58, 1888.

*Aplozia riparia* var. *rivularis* Bernet Cat. Hep. Suisse 59, 1888.

*Haplozia riparia* K. Muell., Rabenh. Krypt.-Fl. 6(1):559, 1909.

*Haplozia riparia* var. *rivularis* K. Muell., Rabenh. Krypt.-Fl. 6(1):561, 1909.

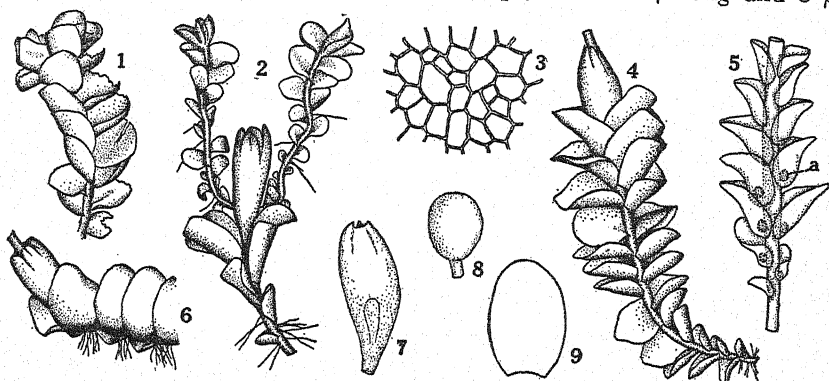
*Aplozia tristis* var. *rivularis* Joerg., Bergens Mus. Skrift. 16:110, 1934.

Plants in patches, yellowish green to olive green. Stems 1-3 cm long, suberect or prostrate with ascending tips, simple or slightly branched, with innovations below the perianth, usually with several stolons. Rhizoids numerous to near the stem tip, hyaline or brown. Leaves alternate, succubous on lower part of stem, often nearly transverse on upper part, not decurrent, approximate to imbricate, horizontal to spreading, on the upper part of the fertile plant often half-clasping the stem, unlobed, broadly ovate to oblong, usually widest near base; apex rounded; margin entire. Cells of the leaf middle 20-40  $\mu$ , of the margin about 20  $\mu$ , 5-6-angled; walls thin, colorless; trigones minute or wanting; oil bodies few, very small, spherical; cuticle usually smooth. Underleaves wanting. Plants unisexual. Male plants in separate tufts; male bracts 8-24, hardly imbricate, erect to spreading, saccate at base; antheridia usually 1, oval-globose, with a short stalk. Female bracts erect-patent to squarrose, like the leaves; bracteole wanting. Perianth clavate to pyriform, free from the bracts,  $\frac{1}{2}$ - $\frac{2}{3}$ -emergent, slightly dorsi-ventrally compressed, the upper third

<sup>114</sup> *tristis* 'tis.



strongly 5-6-plicate, acutely narrowed to the mouth; mouth truncate, with 5 triangular teeth and finely denticulate, its cells about  $20\ \mu$ . Seta 1-2.5 cm long. Sporangium broadly ovoid, deeply black; epidermal cells with dark brown nodular thickenings; cells of inner wall layer with semiannular thickenings. Elaters not attenuate at tips, about  $90\ \mu$  long and  $8\ \mu$



*Jungermannia tristis*. 1, Part of plant, dorsal view,  $\times 8.4$ . 2, Plant with perianth, dorsal view,  $\times 7.2$ . 3, Leaf cells,  $\times 157$ . 4, Shoot with perianth, dorsal view,  $\times 6.8$ . 5, Male inflorescence with antheridia (a),  $\times 15.3$ . 6, Part of shoot with perianth, side view,  $\times 78$ . 7, Perianth,  $\times 10.2$ . 8, Antheridium,  $\times 72$ . 9, Leaf,  $\times 8.4$ . (1, original, by Helen Gilkey; 5, 7-8, after Pearson; the others after K. Mueller.)

wide; spirals 2, scarcely spirally coiled, reddish brown. Spores  $14-18\ \mu$ , finely granulate, reddish brown. Name from *L. tristis*, dismal; we do not know to what this applies, unless it should be to the often muddy dull green color.—Among wet rocks, in mountains; or submerged, in streams, on rock.

ILLUSTRATIONS: Pearson (433) 2: pl. 124; K. Mueller (409) 1: figs. 281-282; Macvicar (374) 147, figs. 1-5; Meylan (386) fig. 83; Gil (76) figs. 218-219.

EXAMINATIONS: *Alta.* Waterton Park (Rakestraw) 1936.—*B. C.* Cougar Lake (Brinkman) 1910; Glacier (Taylor 134) 1921.—*Cal.* Crescent City (Frye) 1933; Willow Creek (Rakestraw) 1936.—*Mont.* Glacier National Park (Frye) 1934; Many Glaciers in Glacier National Park (Frye) 1928.—*N.C.* Winston-Salem (Schallert) 1923.—*Ore.* Crater Lake (Frye) 1933.—*Wash.* Aberdeen (Foster 946) 1909; Lake Kaches (Svihla) 1931; Olympic Mts. (Frye) 1907.

TYPE LOCALITY: On "Radstaedter" Tower in western Germany (Funck).

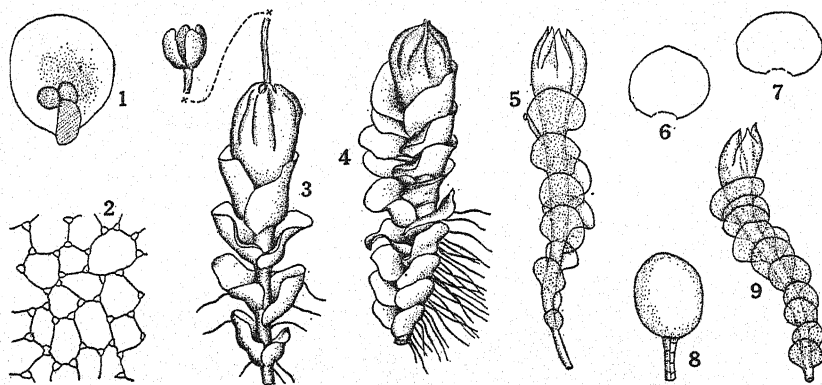
RANGE: N. C., Mont. (81), Alta. (46.2), B. C. (51), Wash. (80), Ore. (84), Cal. (84.1); Eur. (524.2).

It is clear from the synonymy that the specific name *tristis* has the priority, as pointed out by Joergensen (325).

Brinkman (51) reports what he considers the var. *rivularis* from British Columbia. This is the only North American material which has been referred to the variety. We view it as merely a submerged ecological form.

12. *Jungermannia sphaerocarpa*<sup>115</sup> Hook. Brit. Jung. pl. 74, 1816.*J. scalariformis* Nees Naturg. Eur. Leberm. 2:463, 1836.*Aplozia sphaerocarpa* Dum. Hep. Eur. 61, 1874.*J. goulardi* Husnot Hep. Gallica 29, 1881.*Solenostoma sphaerocarpa*<sup>116</sup> Steph., Bull. Herb. Boissier, Ser. 2, 1:499, 1901; also Sp. Hep. 2:61, 1901.*Aplozia goulardi* Boulay Musc. France 2:129, 1904.*Haplozia sphaerocarpa* K. Muell., Rabenh. Krypt.-Fl. 6(1):546, 1909.

Plants in tufts or patches, pale green to brown. Stems 1-3 cm long, erect or ascending, simple or frequently with small-leaved innovations. Rhizoids numerous to near tip of stem, long, hyaline or sometimes violet toward their tips. Leaves alternate, succubous on lower part of stem, nearly transverse on upper, somewhat clasping, distant to approximate, on the fertile plant erect-patent and slightly larger upward on stem, on the sterile plant widely spreading and squarrose, concave, orbicular, not or hardly bilobed, the dorsal margin decurrent; apex rounded to retuse; margin entire. Cells of the leaf middle 25-35  $\mu$ , of the margin 18-22  $\mu$ , of the base 25 by 50  $\mu$ , 4-6-angled, with thin walls; marginal row of cells



*Jungermannia sphaerocarpa*. 1, Male bract with 2 antheridia,  $\times 10.2$ . 2, Leaf cells,  $\times 176$ . 3, Shoot with sporophyte, dorsal view,  $\times 8.3$ . 4, Shoot with perianth, dorso-lateral view,  $\times 8.3$ . 5, Shoot with perianth, side view,  $\times 6.8$ . 6-7, Leaves,  $\times 8.3$ . 8, Antheridium,  $\times 72$ . 9, Shoot with perianth, side view,  $\times 6.8$ . (1, 5, 8-9, after Pearson; the others after K. Mueller.)

quadrate, 18-22  $\mu$ , not or hardly larger than the second row, often hyaline-brown, forming a somewhat distinct border; trigones usually small but distinct; cuticle smooth. Underleaves wanting. Plants bisexual. Male bracts immediately below the female ones; antheridia 2-3, with short stalks. Female bracts wider than the leaves, erect-patent. Perianth  $\frac{1}{2}$ - $\frac{2}{3}$ -emergent, obovate to clavate, free from the bracts, slightly laterally

<sup>115</sup> sfär ö kär' pä.<sup>116</sup> Since 1909 some writers use *S. sphaerocarpum* to make the species agree with the genus *Solenostoma* in gender.

compressed, 3-6-angled above, smooth below, suddenly constricted to the mouth; mouth shortly tubular, with 3-6 crenations; cells of the mouth mostly oblong, about  $25\ \mu$  wide. Seta 1-2 cm long. Sporangium spherical, reddish brown; cells of the epidermis with numerous nodular thickenings; cells of the inner wall layer with semiannular thickenings. Elaters about  $120\ \mu$  long, 7-10  $\mu$  thick; spirals 2, 4-5  $\mu$  thick, closely coiled, reddish brown. Spores 16-20  $\mu$ , finely verruculose, reddish brown. Name from Gk. *sphaera*, sphere, and *karpós*, fruit; in reference to the spherical sporangium.—On damp soil or rocks.

ILLUSTRATIONS: Pearson (433) 2: pl. 125; Hooker (285) pl. 74; K. Mueller (409) 1: fig. 277; Ekart (124) pl. 3, fig. 20; Macvicar (374) 144, figs. 1-4; Meylan (386) fig. 80; Gil (76) fig. 215.

EXAMINATIONS: *Alta.* Banff National Park (Rakestraw) 1937.—*B. C.* O'Hara Lake near Hector (Brinkman) 1912.—*Cal.* Sierra County (Sutcliffe) 1927.—*Mich.* Tahquamenon Falls (Nichols) 1923.—*Minn.* Cook County (Conklin) 1911.—*Mont.* Glacier National Park (Miller) 1934; Many Glaciers in Glacier National Park (Frye) 1928.—*N. H.* Waterville (Lorenz) 1906.—*Que.* Mt. Royal near Montreal (Dupret).—*Wash.* Pacific Beach (Foster 1500) 1911; Stevens Pass (Frye) 1934.—*Wis.* French River (Conklin) 1910; Orienta Falls in Bayfield County (Conklin) 1923.—*Wyo.* Centennial (Frye) 1931.

TYPE LOCALITY: Cadnam bog near Dublin, Ireland (Lyell).

RANGE: Greenland (320), Ellesmere Isl. (485.1), Baffin Isl. (277.2), Keewatin District (277.2), Labrador (510), Que., Me. (191), N. H. (359.1), Mich. (419.1), Wis. (98), Minn. (97.1), Iowa (89), Colo. (175), Wyo. (81), Mont., Alta. (46.2), Alaska (239.1), B. C. (51), Wash. (81), Cal. (51); Asia (350); Eur. (524.2); Iceland (350.1); Jan Mayen Isl. (320.4).

12a. *Jungermannia sphaerocarpa* var. *nana*<sup>117</sup> (K. Muell.) n. comb.

*J. nana* Nees Naturg. Eur. Leberm. 1:317, 1833.

*Aplogia nana* Breidl., Mitt. Naturw. Ver. Steiermark 30: 304, 1893.

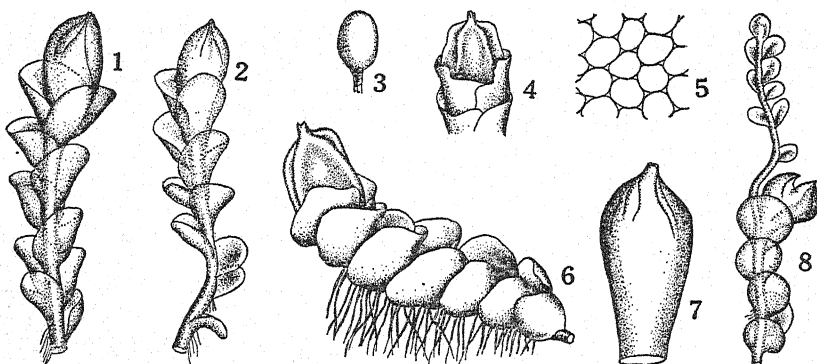
*J. sphaerocarpa* var. *lurida* Pears. Hep. Brit. Isles 298, 1902. Doubtfully *Aplogia lurida* Dum. Hep. Eur. 60, 1874.

*Haplogia sphaerocarpa* var. *nana* K. Muell., Rabenh. Krypt.-Fl. 6(1):548, 1909.

*Aplogia sphaerocarpa* var. *nana* Macvicar, Stud. Handb. Brit. Hep., Ed. 1, 140, 1912.

Plants in small compact tufts or patches, small, yellowish brown or dark reddish to blackish brown or reddish green. Stems 1-2 cm long, erect. Rhizoids usually numerous especially on fertile stems. Leaves of fertile stems erect-appressed and usually wider than in the type, of sterile stems spreading to erect-appressed. Cells of leaves thin-walled; trigones small. Female bracts wide, appressed. Perianth sharply 4-angled, distinctly tubular. Name the *L. nanus*, dwarf; because the plant is often quite small.—On wet rocks and margins of streams.

<sup>117</sup> nã' nã.



*Jungermannia sphaerocarpa* var. *nana*. 1-2, Shoot with perianth, x8.5. 3, Antheridium, x45. 4, Perianth, dorsal view, x10.6. 5, Leaf cells x154. 6, Shoot with perianth, x10.6. 7, Perianth, x12.7. 8, Shoot with imperfect perianth and rejuvenation, x10.6. (1-3, 5, 7-8, after Pearson; 4, 6, after K. Mueller.)

ILLUSTRATIONS: Pearson (433) 2: pl. 126; Lindenberg, Syn. Hep. Eur. pl. 2, 1829 (except perhaps fig. 4, according to Nees Naturg. Eur. Leberm. 1:320, 1833); Meylan (386) fig. 81; K. Muell. (409) 1: fig. 278.

EXAMINATIONS: None.

TYPE LOCALITY: European.

RANGE: Greenland (248); Asia (19.05); Eur. (409).

12b. *Jungermannia sphaerocarpa* var. *amplexicaulis*<sup>118</sup> (Dum.) n. comb.

*J. cordifolia* Mart. Fl. Crypt. Erlangensis 183, pl. 6, fig. 59, 1817. Not of Hook. Brit. Jung. pl. 52, 1816.

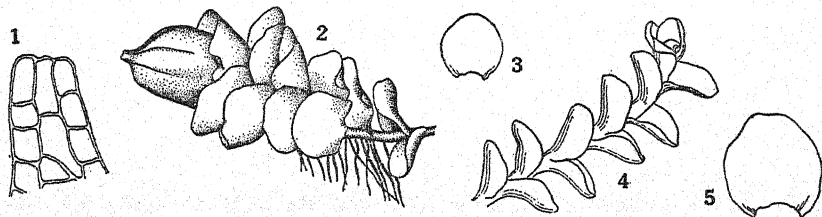
*J. amplexicaulis* Dum. Syll. Jung. Eur. 50, 1831.

*J. tersa* Nees Naturg. Eur. Leberm. 1:329, 1833.

*Aplozia amplexicaulis* Dum. Hep. Eur. 60, 1874.

*Solenostoma amplexicaulis*<sup>119</sup> Steph., Bull. Herb. Boissier, Ser. 2, 1:496, 1901; also Sp. Hep. 2:58, 1901.

*Haplogia sphaerocarpa* var. *amplexicaulis* K. Muell., Rabenh. Krypt.-Fl. 6(1):549, 1909.



*Jungermannia sphaerocarpa* var. *amplexicaulis*. 1, Cells at mouth of perianth, x193. 2, Shoot with perianth, x8.5. 3, Leaf, x11. 4, Sterile shoot, dorsal view, x11. 5, Female bract, x11. (2, After K. Mueller; all others original, by Elizabeth Curtis.)

<sup>118</sup> *ám plëx i ka' lis.*

<sup>119</sup> K. Muell. (409) 1:459, uses *amplexicaule* to agree in gender with *Solenostoma*.



Leaves broadly cordate to circinate, almost completely crossing the stem at dorsal insertion and about half so at the ventral. Cells of the leaf middle 30-40  $\mu$ , of the margin 18-25  $\mu$ ; trigones lacking or few. Name from the *L. amplexor*, to embrace, and *caulis*, stem; in reference to the clasping leaves.—On wet rocks and wet stony soil.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 279; Martius, Fl. Crypt. Erlangensis pl. 6, fig. 59, 1817, as *Jungermannia cordifolia*.

EXAMINATIONS: None.

TYPE LOCALITY: European.

RANGE: B. C. (390); Wyo. (454); Eur. (119).

13. *Jungermannia caespiticia*<sup>120</sup> Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. Suppl. 14:67, pl. 1, figs. 1-8, 1829.

*J. caespiticia* var. *obtusata* Nees Naturg. Eur. Leberm. 1:320, 1833.

*Aplozia caespitiitia* Dum. Rec. d'Obs. 16, 1835.

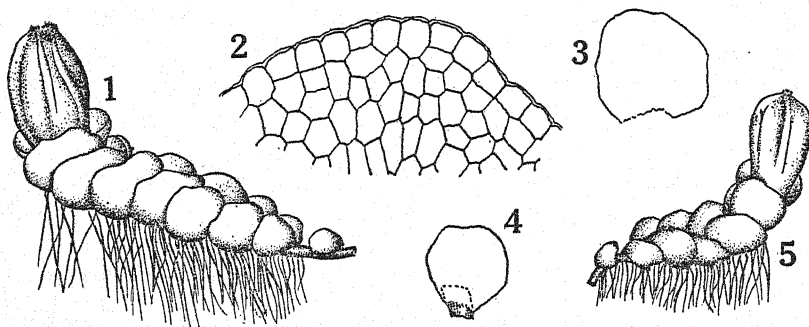
*Solenostoma caespiticia* Steph., Bull. Herb. Boissier, Ser. 2, 1:495, 1901; also Sp. Hep. 2:57, 1901.

*Haplozia caespiticia* K. Muell., Rabenh. Krypt.-Fl. 6(1):544, 1909.

Plants in dense patches or sometimes gregarious, pale green to pale yellowish green. Stems 3-5 cm long, about 350  $\mu$  thick, prostrate with ascending to erect tips, usually simple but commonly with numerous innovations beneath the perianth, the fertile leafy shoots distinctly larger upward. Rhizoids numerous to the tip of the stem, long, hyaline. Leaves alternate, succubous, slightly decurrent on dorsal side, imbricate, erect-appressed and slightly concave at least in the fertile plant, not or hardly bilobed, rotund to subreniform, 450-800  $\mu$  long; apex rounded to emarginate; margin entire or subcrenulate by projecting cells. Cells of the leaf isodiametric, more than usually translucent; those of the median region 32-40 by 40-60  $\mu$ , polygonal; of the margin about 30-32  $\mu$ , of the base about 35-55  $\mu$ ; marginal row quadrate, with somewhat thickened walls, forming a more or less distinct border; other walls very thin; trigones wanting or hardly present; oil bodies spherical to ovoid, distinctly warty in appearance; cuticle smooth. Gemmae roundish-quadrate or rarely somewhat 3-angled, 1-celled, very numerous, in masses, arising endogenously from the end of the stem; masses large, conspicuous, globular, brownish green, closely enclosed by leaves. Underleaves wanting. Plant unisexual. Male plants intermingled with the female, more slender; male inflorescence terminal; male bracts several pairs, transversely inserted, erect-spreading, rather smaller and more concave than the leaves, the dorsal margin frequently with a small blunt tooth near the base; antheridia 1-2, globose, with a very short stalk. Female bracts grading

<sup>120</sup> sēs pī tī' shī ä. Dumortier follows Lindenberg in spelling the species *caespitiitia*. See comment after range.

into the leaves; bracts wider than the leaves and somewhat longer, about 1 by 1.4 mm, embracing the perianth, often the margin sinuate; bracteole entire, acicular to ovate or lingulate, or usually wanting. Perianth oblong-obovoid, free from the bracts, large, about 1.7 mm long and 1 mm wide, about  $\frac{1}{2}$ -emergent, slightly laterally compressed, obtusely 4-5-plicate in the upper part, one cell thick except in the basal  $\frac{1}{4}$ , gradually contracted



*Jungermannia caespiticia*. 1, Plant with perianth,  $\times 14$ . 2, Cells along margin of leaf,  $\times 141$ . 3-4, Leaves, flattened out,  $\times 17.6$ . 5, Plant with perianth,  $\times 14$ . (All after K. Mueller.)

at tip into a mouth; mouth small, with a short tube, crenulate with 4 triangular teeth or crenulations. Seta short. Sporangium spherical, reddish purple; epidermal layer of cells rectangular to polygonal, about  $27 \mu$  wide, with nodular thickenings on the walls; cells of inner layer of wall about  $20 \mu$  wide, with numerous semiannular thickenings. Elaters about  $7 \mu$  thick, bluntly pointed; spirals 2, reddish brown. Spores  $10-16 \mu$ , smooth or minutely verruculose, brownish red. Name the *L. caespiticia*, of a small sod; in reference to the usual dense sods which it forms.—On moist clay, loam or humus.

ILLUSTRATIONS: Lindenberg, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. Suppl. 14: pl. 1, figs. 1-8, 1829; K. Mueller (409) 1: fig. 276; Ekart (124) pl. 11, fig. 95; Warnstorf (523) 154, fig. 3; Macvicar (374) 143, figs. 1-4; Jensen (323.5) 83, 3 figs.

EXAMINATIONS: None.

TYPE LOCALITY: At Bergedorf near Hamburg, Germany (J. B. G. Lindenberg).

RANGE: III. (246.7), Cape Nome in Alaska (136); Eur. (329).

Warnstorf (523) says the var. *obtusata* is merely the gemmiparous male plant.

The original spelling of the species is *caespititia*. K. Mueller (Rabenh. Krypt.-Fl. 6(1): 535, 1909) points out that it should have been *caespiticia*. The poorest name is better than the poorest made into a better one. Further, incorrect spellings are not of prime importance; of much greater importance is it that there be only one name for a plant, always spelled the same. Since practically all recent publications follow K. Mueller it seems unwise to return to the original form.

Stephani wrote *Solenostoma caespiticia*. With the genus *Solenostoma* the species should be *caespititum* or as revised, *caespitium*, to agree in gender with the genus.

*Mylia*<sup>121</sup> S. F. Gray Nat. Arr. Brit. Pl. 1:693, 1821.

*Jungermannia* section *Aplozia* Dum. Syll. Jung. Eur. 47, 1831.

*Leptoscyphus* Mitt., London Jour. Bot. 3:358, 1851.

*Leioscyphus* Mitt. in Hooker Handb. New Zealand Fl. 2:134, 1855.

*Mylia* Carr., Trans. Bot. Soc. Edinburgh 10:305, 1870.

*Coleochila* Dum. Hep. Eur. 105, 1874, in part.

*Clasmatocolea* Spruce, Trans. Bot. Soc. Edinburgh 15:440, 1885.

Plants in large vigorous mats or sods. Stems 0.2-10 cm long, prostrate to erect, simple or sparingly branched, with subfloral innovations; branches lateral. Rhizoids few to numerous, in tufts when numerous, colorless. Leaves alternate, succubous to transverse, dorsally or not at all decurrent, unlobed or rarely 2-lobed by a slight emargination, roundish or oblong to cuneate or ovate-lanceolate, half embracing the stem; margin entire. Cells of the leaf middle 12-55  $\mu$ ; walls thin to moderately thick; trigones small to bulging; cuticle smooth or papillose. Gemmae on the tips of lanceolate leaves or all along their margin, 1-2 celled. Underleaves always present, abundant or moderately so, lanceolate, rather large, entire or rarely toothed. Plants unisexual. Male plants in the same or different mats. Male inflorescence usually median on a stem; antheridia 1-2 per bract. Female inflorescence terminal on an ordinary shoot; female bracts resembling the leaves, not united with each other; bracteole lanceolate, unlobed, not united with the bracts. Perianth oblong to oblong-ovoid, free from the bracts, about  $\frac{1}{2}$ -emergent, inflated below, laterally compressed and keeled above, gradually contracted to the mouth; mouth sinuate or crenulate to 2-5-lobed and ciliate. Seta 7-8 cells thick, in cross section the 18-20 epidermal cells twice as large as the interior ones and thin walled. Sporangium ovoid-globose, coriaceous, the wall of 4 layers of cells; epidermal layer with either semiannular or nodular thickenings or both; the innermost layer with semiannular thickenings. Elaters 12-14  $\mu$  thick; spirals 2, closely wound. Spores 15-20  $\mu$ , verruculose. According to Carrington (Brit. Hep. 66), *Mylius* was a botanist mentioned in Micheli's *Nova Pl. Genera* in 1729.

S. F. Gray's genus *Mylius* was ignored for nearly 40 years, when Carrington changed it into *Mylia*. Dumortier in Hep. Eur. 6, 1874, at the bottom of the page, says that Gray's names are "*ad normam regni animalis, nec plantarum est confecta, contra botanices regulam, et igitur postponenda.*" This is now of interest chiefly in showing the state of mind of the one who wrote it. In our opinion there should be a return to the use of *Mylius* and other masculine names of Gray instead of the later feminine form by Carrington. The reasoning would be the same as that which resulted in returning from *Conocephalus conicus* to *Conocephalum conicum*. Our hesitation arises in balancing the rules of nomen-

<sup>121</sup> мѣ' II ä, according to Underwood (506) 717. Gray wrote it *Mylius*.

clature and injustice to S. F. Gray on the one hand, against the numerous changes in specific endings in changing from the feminine back to the masculine form on the other.

Stems 2-10 cm long; rhizoids numerous, long; leaves roundish to oblong or lanceolate, not notched at tip; cells of the leaf middle 45-55  $\mu$ , the walls thin; trigones bulging; underleaves entire or 2-lobed.

Cuticle of leaves verrucose; leaves roundish to lanceolate; gemmae with thin walls; mouth of the perianth 2-5-lobed and ciliate.

1. *M. taylori*.

Cuticle of leaves smooth; upper leaves usually ovate; gemmae with moderately thick walls; mouth of the perianth sinuate to crenulate.

2. *M. anomala*.

Stems 0.2-1 cm long; rhizoids very scarce, short; leaves roundish to cuneate, occasionally emarginate; cells of the leaf middle 12-22  $\mu$ , the walls moderately thick; trigones small; underleaves with 1-2 marginal teeth, not lobed; cuticle of leaves smooth.

3. *M. cuneifolia*.

1. *Mylia taylori*<sup>122</sup> (Hook.) S. F. Gray Nat. Arr. Brit. Pl. 1:693, 1821.

*Jungermannia taylori* Hook. Brit. Jung. pl. 57, 1816.

*Aplozia taylori* Dum. Rec. d'Obs. 16, 1835.

*Leptoscyphus taylori* Mitt., London Jour. Bot. 3:358, 1851.

*Leioscyphus taylori* Mitt., in Hooker Fl. Antarct. 2(2):134, 1855.

*Coleochila taylori* Dum. Hep. Eur. 106, 1874.

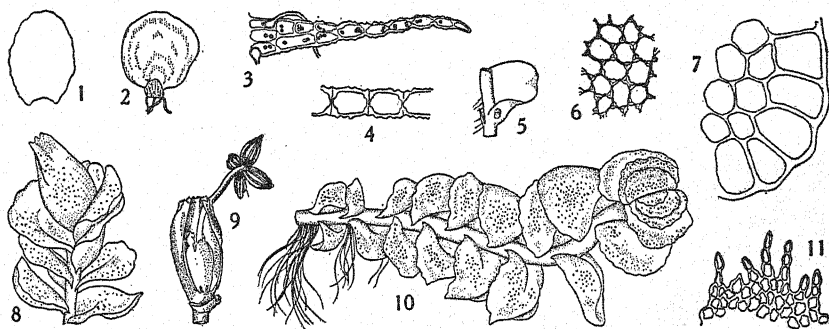
*Jungermannia reticulato-papillata* Steph., Mem. Soc. Nat. Cherbourg 29:215, 1892.

Plants in tufts or sods, yellowish green to reddish purple or reddish brown. Stems 3-10 cm long, ascending to erect, irregularly laterally branched, flexuous, stout, over 500  $\mu$  thick. Rhizoids numerous to tip of stem, long, colorless. Leaves alternate, succubous, shortly dorsally decurrent, distant below to imbricate above, spreading to horizontal, unlobed, circular to oblong, with rather wide insertion, saccate at base; apex rounded; margin entire, the dorsal often reflexed making the leaf more or less horizontal. Cells of the leaf middle 45-55  $\mu$ , of the margin 40-45  $\mu$ , of the base 48-60  $\mu$ , roundish; walls thin except where the trigones are confluent; trigones large, bulging, confluent at base of leaf; oil bodies about 10; cuticle coarsely verrucose. Gemmae not in distinct masses, on the margin at the tip of the upper leaves or as filiform branched or unbranched rows of cells in disorganized upper leaves, oblong to oval, 1-2-celled, 30-45  $\mu$  long, thinly walled, green to reddish brown. Underleaves mostly hidden among the rhizoids, subulate to filiform. Plant unisexual. Male plants among the female ones, with oblong leaves; male inflorescences intercalary, often several on same stem; male bracts 8-16, imbricate, suberect, transversely inserted, the lower half concave, the base saccate; antheridia usually 1-2, oval-globose. Female bracts rather larger than the leaves, erect at base, recurved at tip; bracteole lanceolate. Perianth about  $\frac{1}{2}$ -emergent, oblong, inflated below, laterally compressed

<sup>122</sup> täl' or i. As *Mylius taylori*.



above, unsymmetric, verrucose, its wall 1 cell thick in the upper  $\frac{2}{3}$ , gradually narrowed to the mouth; mouth 2-5-lobed, ciliate, the cilia composed of 6 or fewer verrucose cells. Seta 1.5-2 cm long. Sporangium oval-globose, dark brown, its wall of several layers of cells; epidermal cells



*Mylia taylori*. 1, Leaf,  $\times 34$ . 2, Leaf,  $\times$  about 3. 3, Underleaf with two rhizoids at base,  $\times 51$ . 4, Part of cross section of leaf showing cuticular papillae,  $\times 136$ . 5, Male bract, dorsal view,  $\times$  about 3. 6, Cells of the leaf middle,  $\times 55$ . 7, Part of cross section of seta,  $\times 106$ . 8, Tip of shoot with perianth,  $\times 5.1$ . 9, Perianth cut open,  $\times$  about 5. 10, Sterile shoot, dorsal view,  $\times 5.1$ . 11, Part of the mouth of the perianth,  $\times 42$ . (1, 3-4, 6-8, 10-11, after K. Mueller; 2, after Carrington; 5, 9, after Hooker.)

with nodular thickenings and sometimes also with some semiannular ones; innermost layer with numerous complete semiannular thickenings. Elaters 12-14  $\mu$  thick, spirals 2, closely wound, reddish brown. Spores 15-20  $\mu$ , rough or reticulate, brown or yellowish brown. Named in honor of Dr. Thomas Taylor, a noted English writer on bryophytes.—On dead or living trees, on rocks or peaty dirt, or among peat mosses; subalpine.

ILLUSTRATIONS: K. Mueller (409) 1: figs. 343-344; Pearson (433) 2: pl. 109; Hooker (286) pl. 57; Carrington, Brit. Hep. pl. 9, fig. 30, 1874-1876; Macvicar (374) 235, figs. 1-3; Warnstorf (523) 141, fig. 6, b, d; Underwood (506) pl. 25; Gil (76) fig. 252.

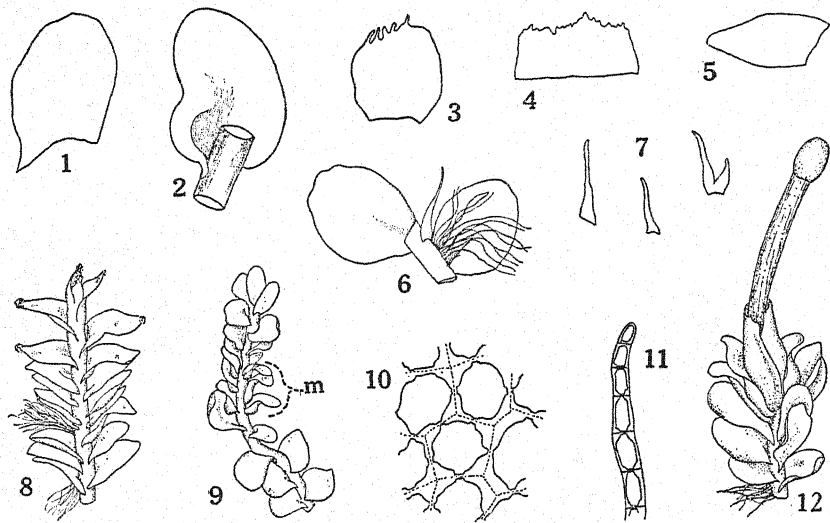
EXAMINATIONS: *Alaska*. Augustine Bay (Frye) 1913; Juneau (Mehner) 1904; Ketchikan (Frye) 1913.—*B. C.* Lewis Island (Frye) 1913; Port Renfrew on Vancouver Island (Gibbs) 1901.—*Newfoundland*. Channel (Howe and Lang) 1901.—*N. H.* Crystal Cascade in White Mts. (Underwood and Cook) 1889.—*N. Y.* Lake Placid (Britton).

TYPE LOCALITY: Toulagee Mt. in Wicklow County, Ireland (Dr. Thomas Taylor).

RANGE: Greenland (320), Labrador (510), Newfoundland (373), Miquelon Isl. (373), N. S. (53.2), Que. (178), Me. (169), N. H. (359), Vt. (169), R. I. (140), N. Y. (506), Ill. (529), Alta. (373), Alaska (135), B. C. (508), Wash. (454), N. C. (12); Asia (325); Eur. (329).

2. *Mylia anomala*<sup>123</sup> (Hook.) S. F. Gray Nat. Arr. Brit. Pl. 1:693, 1821.*Jungermannia anomala* Hook. Brit. Jung. pl. 34, 1816.*Jungermannia taylori* var. *anomala* Nees Naturg. Eur. Leberm. 2:455, 1836.*Leptoscyphus anomalus* Mitt., London Jour. Bot. 3:358, 1851.*Coleochila anomala* Dum. Hep. Eur. 106, 1874.*M. taylori* subsp. *anomala* Carr. Brit. Hep. 68, 1875.*Aplosia anomala* Warnst., Krypt.-Fl. Mark Brandenburg 1:144, 1902.*Leioscyphus anomalus* Steph., Bull. Herb. Boissier, Ser. 2, 5: 1144, 1905; also Sp. Hep. 3:16, 1905.

Plants creeping among *Sphagnum* or in loose to rarely dense patches, yellowish green to yellowish brown; leafy shoots about 3 mm wide. Stems 2-4 cm long, procumbent, or between mosses erect, usually simple, or with few branches, flexuous, stout; in cross section the interior cells polygonal and with distinct trigones, the cortical cells little smaller and thin-walled. Rhizoids numerous to apex of stem, tufted, long, colorless. Leaves alternate, succubous but little so and almost transverse near tip of stem, slightly decurrent dorsally, distant to imbricate, spreading, not lobed, concave, with fairly wide insertion, those near the stem tip usually different from those farther down; apical leaves usually ovate-lanceolate, gemmiparously erose at tip, their margins incurved; other leaves roundish to roundish-oblong, the apex rounded, the margin entire and plane



*Mylia anomala*. 1, Leaf, x6.6. 2, Male bract, x25. 3, Female bract, x6.6. 4, Part of mouth of perianth, x4.2. 5, Leaf of gemmiparous plant, x8.4. 6, Part of shoot, ventral view, x8.4. 7, Three underleaves, x6.6. 8, Tip of gemmiparous plant, dorsal view, x4.2. 9, Tip of male shoot, dorsal view, with male (m) bracts, x4.2. 10, Median leaf cells, x160. 11, Tip of underleaf, x93. 12, Tip of plant with sporophyte, x4.2. (10, Original by Helen M. Gilkey; 4-6, 8-9, 12, after K. Mueller; the others after Jensen.)

<sup>123</sup> à nôm' à là. As *Mylius anomalus*.

or nearly so. Cells of the leaf middle 45-55  $\mu$ , of the margin 42-47  $\mu$ , of the base 55-70  $\mu$ , roundish or oval, at margin subquadrate, at middle and often at tip of apical leaves 2-5 times as long as wide, walls thin; trigones very large, bulging; cuticle smooth. Gemmae in clusters or scattered, on the margin near tips of upper leaves, spherical or ovoid to oblong-ovoid, mostly 2-celled, rather thickly walled, 35-50  $\mu$  long, yellowish green. Underleaves mostly concealed by rhizoids, broadly subulate to lanceolate, sometimes 2-toothed at tip. Plants unisexual; both inflorescences terminal. Male bracts 10-14, imbricate, suberect, ovate, transversely inserted, concave, saccate at base; antheridia 2, globose. Female bracts similar to the leaves, roundish ovate, erect at base, recurved at apex; bracteole lanceolate. Perianth about  $\frac{1}{2}$ -emergent, oblong-ovoid, inflated below, laterally compressed above, gradually narrowed to mouth; mouth crenulate to sinuate, not toothed. Sporangium ovoid-globose, dark brown; epidermal cells with nodular thickenings; innermost layer with incomplete semi-annular thickenings on the middle and upper parts of the valves. Elaters 12-14  $\mu$  thick; spirals 2, closely wound, reddish brown. Spores 15-20  $\mu$ , rough or reticulate, yellowish brown to brown. The name, *L. anomalus*, without a name; naturally it was nameless when Hooker first examined it.—Among *Sphagnum*, on damp peaty or sandy soil, on decaying wood.

ILLUSTRATIONS: Pearson (433) 2: pl. 110; Carrington, Brit. Hep. pl. 9, fig. 29, 1875; K. Mueller (409) 1: fig. 345; Hooker (285) pl. 34; Macvicar (374) 237, figs. 1-5; Meylan (386) fig. 129; Warnstorf (523) 141, fig. 6, a,c,e-g; Jensen (323.5) 139 and 142, 11 figs.; Steere (485.5) 76, figs. 5-6; Ammons (3.1) 142, fig. E.

EXAMINATIONS: *Alaska*. Juneau (Mehner) 1904; Kalsina Valley (Dickey) 1931; Metlakatla (Frye) 1913.—*Alta*. Nordegg Forest Reserve (Brinkman) 1928.—*Mich*. Cheboygan County (Woollett) 1923.—*N. H.* Franconia Mts. (Evans) 1908.—*Wash*. Hamilton (Foster) 1905; Pacific Beach (Foster) 1911; Seattle (Rigg).

TYPE LOCALITY: Holt, England (Rev. R. B. Francis). Holt is about Lat. 52° 55' N., Long. 1° 6' E.

RANGE: Anticosti Isl. (431), N. S. (413), N. B. (338), Me. (203), N. H. (359), Vt. (241), N. Y. (13.1), Que. (178), Pa. (338), Mich. (502), Wis. (94.1), Alta. (431), Yukon (298), Alaska (173), B. C. (508), Wash. (81), W. Va. (3.2), N. J. (212), Conn. (140), R. I. (169), Mass. (176); Asia (308.1); Eur. (329).

### 3. *Mylia cuneifolia*<sup>124</sup> (Hook.) S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821.

*Jungermannia cuneifolia* Hook. Brit. Jung. pl. 64, 1816.

*Leptoscyphus cuneifolius* Mitt., London Jour. Bot. 3:358, 1851.

*Aplozia cuneifolia* Dum. Hep. Eur. 55, 1874.

*Coleochila cuneifolia* Dum. Hep. Eur. 106, 1874.

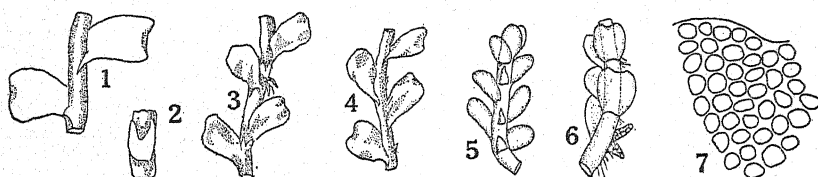
*Clasmatocolea cuneifolia* Spruce, Trans. Bot. Soc. Edinburgh 15:440, 1885.

*Leptoscyphus cuneifolius* Steph., Bull. Herb. Boissier, Ser. 2, 6:218, 1906; and Sp. Hep. 3:18, 1906.

Plants in patches or creeping among mosses, reddish brown; leafy shoots about 333  $\mu$  wide. Stems up to 2-10 mm long, about 50  $\mu$  thick,

<sup>124</sup> kū nē" i fō' li ä. As *Mylius cuneifolius*.

procumbent, simple or branched, filiform, flexuous, rigid, brittle, brown, often partly naked on account of the caducous leaves and underleaves; branches lateral or from the axils of the underleaves. Rhizoids very scarce, short, colorless, only on bases of underleaves. Leaves alternate, almost transversely inserted but with a leaning toward succubous, not or hardly decurrent dorsally, distant to contiguous, erect-spreading, not lobed, cuneate to subrotund, the larger 150-200  $\mu$  long, slightly concave, thick, brittle, quite narrow at base; apex truncate to rounded or occa-



*Mylia cuneifolia*. 1, Part of sterile shoot, dorsal view, x about 48. 2, Underleaf, x about 48. 3, Part of sterile shoot, ventral view, x about 32. 4, Part of sterile shoot, dorsal view, x about 32. 5, Ventral view of shoot, x 45. 6, Side view of shoot, x 45. 7, Cells of the leaf, x 153. (1-4, after Hooker; the others after Pearson.)

sionally retuse; margin entire. Cells of the leaf middle 12-22  $\mu$ , averaging about 18  $\mu$ , those of margin and base about the same, isodiametric, polygonal; walls moderately thick, yellowish brown to reddish brown; trigones small but well defined; cuticle smooth. Gemmae unknown; vegetative reproduction by the development of new plants from the marginal cells of the fallen leaves. Underleaves numerous, distinct, quite variable, erect-spreading to spreading, ovate-triangular to cuneate or subulate, rarely 2-lobed, averaging about 100  $\mu$  long and 50  $\mu$  wide, mostly acute to acuminate, entire or occasionally with a blunt tooth on one or both margins. Reproduction and sporophyte seem to be unknown. Name from *L. cuneus*, a wedge, and *folium*, a leaf; because usually some of the leaves are cuneate.—On trunks of trees, on rocks, on other mosses; in shade; subalpine.

ILLUSTRATIONS: Hooker (285) pl. 64; Pearson (433) 2: pl. 105; Macvicar (374) 238, figs. 1-4.

EXAMINATIONS: N. C. Clingmans Dome (Taylor 2809) 1934.—Tenn. Mt. LeConte in Sevier County (Sharp) 1935.

TYPE LOCALITY: Near Bantry, Ireland (Miss Ellen Hutchins).

RANGE: N. C. (465.1), Tenn.; Eur. (325).

It is not probable that the plant is limited in North America to North Carolina and Tennessee. Very likely it is widely distributed but has not been recognized. Its small size and the absence of reproduction would make it an easy one to overlook unless found in considerable quantity.



*Mesoptychia*<sup>128</sup> (Lindb. & Arn.) Evans, Ann. Bryologici 10(1937):4, 1938.

*Jungermannia* section *Mesoptychia* Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):39, 1889.

Plants large. Leaves alternate, succubous but almost transversely inserted, wider than long, truncate to retuse, with a convex longitudinal fold near the middle adaxially, entire except for tendency to be 2-lobed, both margins strongly reflexed so that they approach each other; lobes when present slightly apiculate. Underleaves present throughout, deeply 2-lobed; the lobes divergent, ciliate-lacinate. Plants unisexual. Female bracts emarginate; bracteole similar to the leaves but larger. Perianth beaked (when young), with a high dorsal crest or fold. Name from Gk. *mesos*, in the middle, and *ptyche*, a fold; in reference to the prominent dorsal fold of the perianth.

1. *Mesoptychia sahlbergii*<sup>128</sup> (Lindb. & Arn.) Evans, Ann. Bryologici 10(1937):4, 1938.

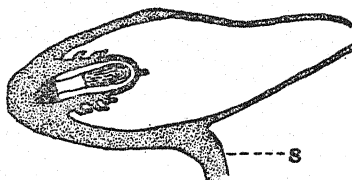
*Jungermannia* (section *Mesoptychia*) *sahlbergii* Lindb. & Arn., Kgl. Sv. Vet.-Akad. Handl. 23(5):40, 1889.

*Lophozia sahlbergii* Steph., Bull. Herb. Boissier, Ser. 2, 1:1149, 1901; also Sp. Hep. 2:132, 1901.

Plants loosely caespitose, brownish green to purplish brown; leafy shoots about 5 mm wide toward tip, carinate dorsally, strongly keeled ventrally. Stems up to 6 cm long, almost black dorsally, purplish ventrally, with one or rarely two innovations from beneath the perianth. Rhizoids numerous, short, brownish violet. Leaves alternate, succubous but nearly transversely inserted, slightly decurrent dorsally, most of them slightly 2-lobed, transversely elliptic in general form, usually convex adaxially, with a longitudinal convex fold adaxially; margins entire to slightly crenulate, both strongly recurved; lobes when present inclined to be apiculate, the dorsal apiculus rather the longer; sinus very shallow, not descending over  $\frac{1}{12}$  the leaf length. Cells of the leaf middle about 40  $\mu$ , of the margin and apex about 33  $\mu$ , of the base about 40  $\mu$ , roundedly or ovaly polygonal; walls thin; cuticle verruculose. Gemmae unknown. Underleaves present throughout, much hidden by rhizoids, small for the size of the plant, purplish violet, 2-lobed almost to base, densely ciliate-lacinate along the lower part of the margins; the lobes subulate from an ovate base, divergent. Plants unisexual. Antheridia up to 16. Female bracts like the leaves but larger, emarginate, distinctly apiculate, with one deep adaxially convex fold; bracteole similar to the bracts, larger, less deeply dissected. Perianth (seen young only) about 3 mm long and 1.75 wide, ovoid-ellipsoid, curved upward, ventrally slightly compressed and

<sup>128</sup> мѣс ѓ тѣх' і а.  
<sup>129</sup> сѣл бѣр' гі і.

with a rounded convex fold, dorsally more compressed and with a single high blunt crest, hardly to very slightly beaked at tip, its wall 1 cell thick; mouth small, densely and shortly ciliate; the cilia straight, composed of



*Mesoptychia sahlbergii*. Longitudinal section through perianth and tip of stem (s); diagrammatic. (After K. Mueller.)

3-4 cells. Female inflorescence resulting in a perigynium at right angles to the direction of the stem. Details of the reproduction apparently unknown. Named in honor of Dr. J. Sahlberg, an entomologist who was attached to Arnell's Siberian expedition on which he also gathered some bryophytes including this species.—On damp limestone and damp calcareous earth.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 362, IV.

EXAMINATIONS: None.

TYPE LOCALITY: Mjelnitsa, Yenisei River, Siberia (Dr. J. Sahlberg) July, 1876. About Lat. 65° 30' N.

RANGE: Ellesmere Isl. (56.01), Yukon (51), Alaska (56.01); Asia (350).

*Nardia*<sup>127</sup> S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821, in part.

*Jungermannia* in part, of Schrader and others.

*Mesophylla* Dum. Comm. Bot. 112, 1822, in part.

*Alicularia* Corda, Opiz, Beitr. 1:652, 1828.

Plants more or less in mats, small to rather large. Stems prostrate to suberect, simple to little branched; branches arising in the ventral part of the leaf axils. Rhizoids usually numerous, long, pale. Leaves alternate, succubous, or nearly transverse near female inflorescence, erect-incurved near the perianth and dorsally secund, roundish to wider than long; apex rarely emarginate; margin entire. Cells of the leaf middle rounded to hexagonal; walls slightly thickened; trigones present or wanting; cuticle smooth. Underleaves present but not throughout, lanceolate to subulate, small, larger near the stem tip. Plants unisexual or bisexual. Male inflorescence terminal or, in bisexual species, farther down on same stem as female; male bracts often numerous, saccate. Female bracts similar to the leaves of sterile stems, often larger. Perianth immersed, united with the bracts for a part of its length, contracted at tip, with the stem tip in

<sup>127</sup> när' dĩ ä. Gray used the masculine form *Nardius*. Carrington (Brit. Hep. 10, 1875) first used the feminine form *Nardia*.

some species forming a bulbous or saccate perigynium with rhizoids at base; mouth crenulate. Calyptra free. Elaters with 2 or sometimes with 3 spirals. Sporangium ovoid-globose, opening by 4 valves, its wall of 2 layers of cells; epidermal cells large, their walls with nodular thickenings; inner wall layer of much smaller cells, with semiannular thickenings.—Named in honor of S. Nardi, an Italian abbot.

- A. None of the leaves notched at tip; plants unisexual; female plant not developing a sac-like perigynium beneath the seta, the somewhat thick hollow perianth parallel with the stem tip; oil bodies present in the leaf cells.
- B. Leaves reniform, the marginal row of cells smaller than the second row; underleaves scarce; in cross section of stem the epidermal cells larger than the interior ones. .... 1. *N. compressa*.
- BB. Leaves orbicular, the marginal row of cells about the same size as the second row; underleaves abundant; in cross section of stem the epidermal cells smaller than the interior ones.
- C. Trigones not or occasionally slightly bulging; underleaves free from leaves; rhizoids colorless. .... 2. *N. scalaris*.
- CC. Trigones distinctly bulging; underleaves mostly united at base with a leaf; rhizoids colorless to straw-colored or reddish. .... 3. *N. cavana*.
- AA. All but occasional leaves notched at tip; cells of the leaf margin smaller than the median ones; female plant developing a sac-like perigynium beneath the seta at about a right angle to the stem tip or at a distinct angle with it.
- D. Leaves about circular, sometimes not notched at tip; median leaf cells 20-40  $\mu$ , the walls thin; trigones small to bulging into the cells; elaters with 2 spirals.
- E. Stems quite thick; underleaves sometimes united with the decurrent dorsal bases of the leaves of one row; plants unisexual; male inflorescence terminal but becoming intercalary by rejuvenation from the tip of the branch; oil bodies 2-6. .... 4. *N. lescurii*.
- EE. Stems thin, flexuose; underleaves not united with the bases of the leaves; plants bisexual; male inflorescence just below the female one; oil bodies 2-3.
- F. Some of the leaves not notched at tip. .... 6. *N. geoscyphus*.
- FF. All of the leaves notched at tip. .... 6a. var. *insecta*.
- DD. Leaves oblong to oval, all 2-lobed; median leaf cells 14-21  $\mu$ , the walls thickish; trigones obsolete to small; oil bodies wanting; plants unisexual; male inflorescence terminal; elaters mostly with 3 spirals. .... 5. *N. breidlerii*.

1. *Nardia compressa*<sup>128</sup> (Hook.) S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821.

*Jungermannia compressa* Hook. Brit. Jung. pl. 53, 1816.

*Mesophylla compressa* Dum. Comm. Bot. 112, 1822.

*Alicularia scalaris* var. *compressa* Nees Naturg. Eur. Leberm. 2:449, 1836.

*Alicularia compressa* G. L. & N. Syn. Hep. 12, 1844.

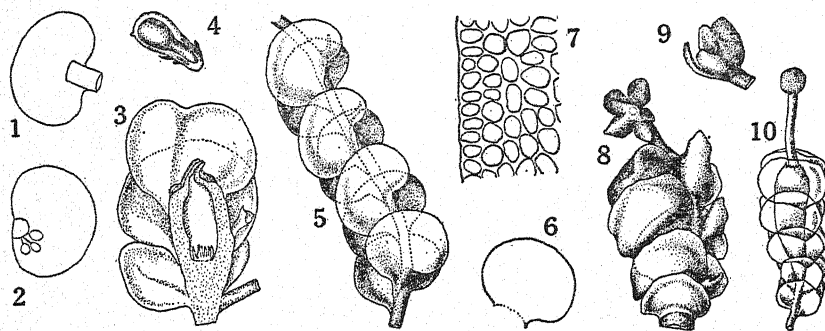
*Alicularia pachyphylla* DeNot., Mem. Accad. Torino, Ser. 2, 18:487, 1859.

*N. scalaris* var. *compressa* Carr. Brit. Hep. 24, 1874-1876.

Plant forming extensive spongy mats, reddish brown to purplish red or rarely dull green, the leafy shoots 2-3 mm wide. Stems 2-15 cm long, slender, not brittle, simple or with few branches, erect or suberect, inno-

<sup>128</sup> kőm prēs' sã. Gray used *Nardius compressus*.

vating; in cross section of stem the cortical cells larger than the small interior cells; flagella present or wanting. Rhizoids few below, almost none upwards, whitish. Leaves alternate, succubous, slightly decurrent, imbricate, erect-appressed, unlobed, reniform to rarely orbicular, thin, about 1.8 mm long and 2-3 mm wide, slightly convex, extending broadly and almost equally beyond the stem on both sides; apex rounded. Cells of the leaf middle  $28-50\ \mu$ ; those of the margin about  $20\ \mu$ , subquadrate; of the base somewhat elongate; walls thin; trigones small to large; oil bodies sometimes distinct. Underleaves scarce except near tip of stem and on innovations, triangular to ligulate or rarely somewhat bilobed at apex, small, suberect. Plants unisexual. Male inflorescence terminal;



*Nardia compressa*. 1, Leaf,  $\times 8.5$ . 2, Male bract with antheridia,  $\times 8.5$ . 3, Longitudinal section of perianth,  $\times$  about 16. 4, Sporophyte with calyptra bearing sterile archegonia,  $\times 26$ . 5, Part of sterile shoot, lateral view,  $\times 16$ . 6, Leaf,  $\times 13.7$ . 7, Cells along leaf margin,  $\times 106$ . 8, Side view of tip of shoot with sporophyte,  $\times 16$ . 9, Ruptured sporangium,  $\times 32$ . 10, Shoot with sporophyte,  $\times$  about 8. (1-3, after Pearson; 4-5, 7-9, after K. Mueller; 6, after Meylan; 10, after Hooker.)

bracts 6-8; antheridia 2-3, ovoid-globose, on a stalk about half their length. Female bracts resembling the leaves, wider, flat, compressed; stem not ventrally saccate under the seta; bracteoles ovate, irregularly lobed; bracts and bracteoles not united with each other. Perianth obconic or clavate, the free part conic, the lower  $\frac{1}{2}-\frac{2}{3}$  united with the upper bracts, the free portion violet; mouth contracted, with long crenulations. Seta 5-10 mm long. Sporangium broadly ovoid, reddish brown, opening by 4 valves to base; walls of the epidermal cells with brown nodular thickenings, of the inner cells with reddish brown semiannular ones. Elaters  $8-12\ \mu$  thick; spirals 2, reddish brown. Spores  $10-16\ \mu$ , granulate, reddish brown. Name in reference to the laterally compressed leafy shoots.—Semiaquatic along mountain rivulets, on rocks.



ILLUSTRATIONS: K. Mueller (409) 1: fig. 266; Hooker (285) pl. 58; Pearson (433) 2: pl. 160; Ekart (124) pl. 1, fig. 5; Carrington, Brit. Hep. pl. 3, fig. 9, 1874-1876; Macvicar (374) 124, figs. 1-4; Gil (76) fig. 204.

EXAMINATIONS: None.

TYPE LOCALITY: Near Bantry,<sup>129</sup> Ireland (Hutchins).

RANGE: Greenland (431); Atka Isl. in Alaska (373); Asia (325); Iceland (350.1); Eur. (19).

2. *Nardia scalaris*<sup>130</sup> (Schr.) S. F. Gray Nat. Arr. Brit. Pl. 1:694, 1821.

*Jungermannia scalaris* Schrad. Syst. Samml. Krypt. Gewaechse 2:4, 1797.

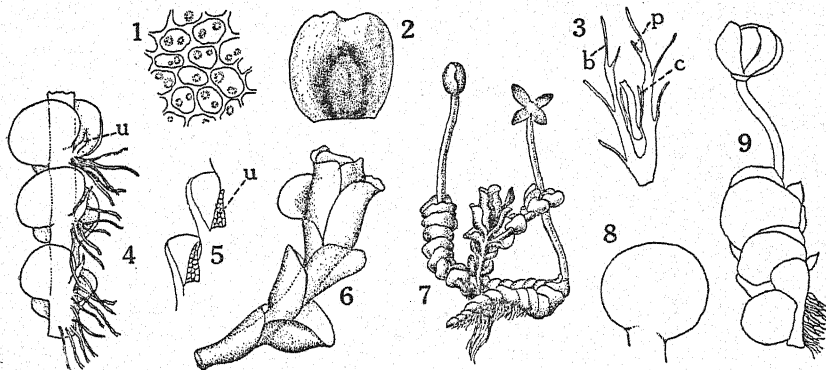
*Mesophylla scalaris* Dum. Comm. Bot. 112, 1822.

*Alicularia scalaris* Corda, Opiz, Beitr. 652, 1828.

*Alicularia rotaeana* DeNot., Mem. Accad. Torino, Ser. 2, 18:484, 1859. (According to Massalongo in Bull. Herb. Boissier, Ser. 2, 2:40, 1902.)

*Mesophylla rotaeana* Dum. Hep. Eur. 130, 1874.

Plants in patches to extensive mats, green to reddish brown. Stems 1-5 cm long, thick, brittle, prostrate with ascending tips, simple or with few branches, in cross section the cortical cells smaller than the interior ones. Rhizoids abundant, white. Leaves alternate, succubous, very slightly decurrent, not overlapping to rather crowded, erect-spreading to spread-



*Nardia scalaris*. 1, Leaf cells,  $\times 143$ . 2, Female bract,  $\times 12.7$ . 3, Longitudinal section of perigynium, with calyptra (*c*), perianth (*p*), and female bracts (*b*),  $\times 6.6$ . 4, Part of stem, side view, with underleaves (*u*),  $\times 5.3$ . 5, Part of plant showing 2 underleaves (*u*),  $\times 16$ . 6, Tip of shoot with perianth,  $\times 12.7$ . 7, Plant with sporophytes,  $\times 3.7$ . 8, Leaf,  $\times 10.6$ . 9, Tip of shoot with sporophyte,  $\times 6.6$ . (1, after Rejment; 2, 6, after Pearson; 3, 5, 9, after Jensen; 4, 7-8, after K. Mueller.)

ing, unlobed, orbicular or nearly so, concave, 600-900  $\mu$  long; 700-800  $\mu$  wide; apex rounded. Cells of the leaf middle 25-50  $\mu$ , of the margin hardly smaller; trigones large, distinct, sometimes bulging into the cells; oil bodies 2-4 in each cell, large, ovoid to kidney-shaped, grayish. Under-

<sup>129</sup> Bantry is in S.W. Ireland in the county of Cork. Nees in his *Naturg. Eur. Leberm.* 1:289, 1833, refers it to Scotland.

<sup>130</sup> skā lā' ris. Gray used the genus *Nardius*.

leaves numerous, lanceolate to triangular-subulate, spreading from the stem, acute to acuminate, entire; union of an underleaf with a leaf has been observed. Plants unisexual. Male inflorescence terminal or about the middle of the shoot; male bracts imbricate, in few pairs, more concave than the leaves; antheridia 2-3, globose, on a stalk nearly as long as the body. Female bracts larger than the leaves, concave, not undulate, often emarginate; bracteole lanceolate to triangular-subulate, entire to subdentate, slightly connate with the bracts. Perianth short, hidden by the female bracts, narrowly pryoriform, lower  $\frac{1}{2}$ - $\frac{3}{4}$  united with the bracts; mouth contracted, crenulate; the stem not becoming tuberous under the seta. Seta 1-2 cm long. Sporangium broadly ovoid, dark brown; epidermal cells large, their walls with nodular thickenings; cells of the inner wall layer small, with numerous brown semiannular thickenings. Elaters 150-200  $\mu$  long, 8-10  $\mu$  wide; spirals 2, wide, reddish brown. Spores 16-18  $\mu$ , granular-papillate, yellowish brown. Name from *L. scala*, a ladder; probably in reference to the leaf arrangement.—On damp soil, wet rocks, or among mosses in woods; or in other damp places.

ILLUSTRATIONS: Pearson (433) 2: pl. 161; Carrington, Brit. Hep. pl. 3, fig. 8, 1874-1876; K. Mueller (409) 1: fig. 267; Hooker (285) pl. 61; Meylan (386) fig. 74; Gil (76) fig. 205; Macvicar (374) 126, figs. 1-4; Ekart (124) pl. 6, fig. 47; Jensen (323.5) 83, 5 figs.

EXAMINATIONS: *Me.* Eastport (Evans 88) 1911.—*N. S.* Halifax (Brown 263) 1923.—*Tenn.* Mt. LeConte in Sevier County (Sharp 4129) 1941.—*Wash.* Paradise Valley on Mt. Rainier (Svihla 176) 1931; Mt. Rainier Nat. Park (Grant 6554) 1925.

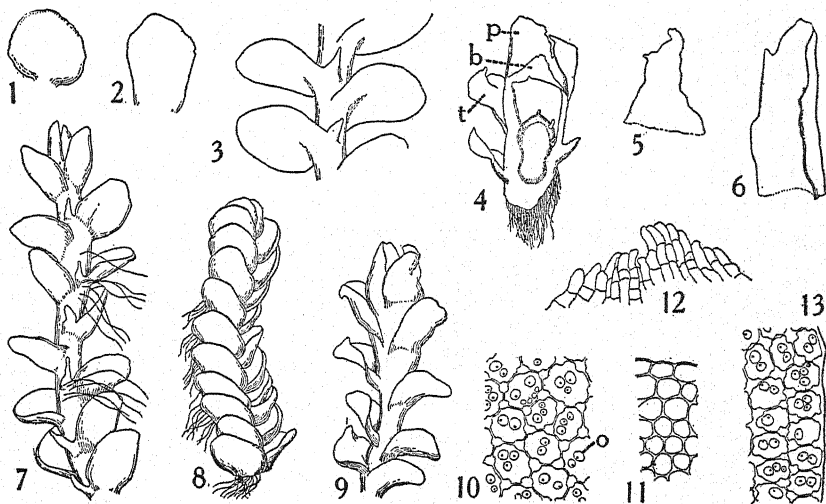
TYPE LOCALITY: European.

RANGE: Greenland (248), Labrador (164), Newfoundland (164), N. S. (53), N. B. (373), Me. (164), Tenn. (465.2), Wyo. (446), Yukon (51), Alaska (239.1), B. C. (431), Wash. (81), Ore. (457); Java (448.092); St. Pauls Isl. in Indian Ocean (448.092); Asia (409); Eur. (325); Canary Isls. (325); Madeira (56.58); Azores (491); Jan Mayen Isl. (320.4).

Schiffner (Lotos, 1901) has recognized a variety *procerior* based chiefly on its erect or almost erect habitat. Brinkman (50) refers Mrs. F. A. MacFadden's No. 5, from Prince Rupert, B. C., to this. He states that it grew among *Dicranum neglectum*. This is rather a large moss, densely tufted, liking very wet situations; and Prince Rupert has such situations both very wet and very abundant. It is well known to any ecologist that an erect habit is assumed by many plants, including many liverworts, when they find themselves in excessive dampness, especially when combined with too little light. Even *Marchantia polymorpha* will grow nearly erect under such conditions. Schiffner's variety *procerior*, on wet ground, is doubtfully justified. The Prince Rupert material we would consider a wet shade form.

3. *Nardia cavana*<sup>131</sup> Clark, Bryologist 43:29, 1940.

Plants in dense mats, green to reddish green or red; leafy shoots of sterile plants 0.5-1.5 mm wide. Stems 4-15 mm long, erect to suberect, usually simple, sometimes dichotomously branched, 275-330  $\mu$  thick; cortical cells 20-25  $\mu$  thick, inner cells 37-51  $\mu$  in diameter; external walls of epidermal cells colorless or reddish, nearly the same in thickness as the other walls. Rhizoids numerous, colorless to straw-colored, scattered, present to near the apex of the stem. Leaves alternate, on sterile and female stems slightly succubously inserted, on male stems transverse, not



*Nardia cavana*. 1, Leaf, x5. 2, Large underleaf, x33. 3, Piece of sterile shoot, ventral view, x17.4. 4, Longitudinal section of perianth (*p*), showing female bracteole (*b*), and bract (*t*), x7.5. 5-6, Female bracteoles, x33. 7, Sterile shoot, ventral view, x12.9. 8, Male shoot, x10. 9, Female shoot, dorsal view, perianth immersed, x7.5. 10, Cells of the leaf middle, with oil bodies (*o*), x130. 11, Cross section of stem from center to margin, x97. 12, Part of mouth of perianth, x77. 13, Cells along leaf margin near tip, x130. (All after Clark.)

decurrent to very slightly so, distant to approximate, erect-spreading, unlobed, orbicular or slightly longer than wide, 0.55-1.2 mm long, 0.55-1.1 mm wide, concave, the insertion reaching dorsally about the middle of the stem; apex rounded or rarely truncate; margin entire or merely undulate to sinuate. Cells of the leaf middle 30-42  $\mu$ , of the base 30-42 by 35-57  $\mu$ ; cells of the marginal row smaller, quadrate, increasing in size toward the base, 16 by 32  $\mu$  at apex, 34 by 38  $\mu$  at base; cells of the second row near apex 27-32  $\mu$ ; walls slightly thickened between trigones, sometimes deeply rose colored; outer walls of the marginal cells about 4  $\mu$

<sup>131</sup> *kā vā' nā*.

thick, distinctly thicker than the interior walls; trigones large, bulging into the cell cavity, usually occasional ones confluent, 6-10  $\mu$  in diameter, thus the cell cavity sinuate to stellate; oil bodies present in fresh material, disappearing when specimens are soaked and dried several times, 2-4 per cell, round to oval as seen in their various positions, smooth, glistening, 15-17  $\mu$  long, 8-12  $\mu$  wide. Underleaves present throughout, subulate to oblong-oval, 66-275  $\mu$  long, entire or with teeth on one or both margins; some of the underleaves on each stem united at the basal margin for a short distance with one of the leaves, this union is with the left row of leaves<sup>132</sup> with exceptions in occasional leaves, the larger free underleaves are oblong-oval and entire. Plants unisexual; male and female plants in the same tuft. Male inflorescence terminal or farther down the stem, at first terminal but becoming intercalary by rejuvenation from the stem tip and thus producing 2 or even 3 successive inflorescences; male bracts 12-16, loosely imbricate, similar to the leaves but more saccate, transversely inserted; antheridia 1-2. Female inflorescence terminal on stem or main branch; female bracts slightly larger than the leaves but otherwise similar to them, united with the (not quite mature) perianth for fully  $\frac{3}{4}$  its length; bracteole large, triangular to broadly so, more or less dentate, united with the perianth, its spreading part free or united for 1-2 cells with one of the bracts. Perianth somewhat fleshy, continuing in the direction of the stem, immersed in the bracts, pyriform, free portion obtusely contracted to the mouth; mouth from not to distinctly beaked, lobed, the lobes denticulate. Calyptra with unfertilized archegonia well up on it. Mature sporophyte and gemmae unknown. The name from *L. cavus*, a cave; on account of its discovery at the mouth of a lava cave.—On dirt which had accumulated over lava rock.

ILLUSTRATIONS: Clark, Bryologist 43:31, figs. 1-19, 1940.

EXAMINATIONS: Type material.

TYPE LOCALITY: Near Cougar, Washington (Lulu Rakestraw), October 3, 1938. About Lat. 46° 3' N., Long. 122° 18' W.

RANGE: Wash. (80.2). Known only from the type locality.

4. *Nardia lescurii*<sup>133</sup> (Aust.) Underw., Bull. Illinois State Lab. Nat. Hist. 2:115, pl. 8, E, 1884.

*Alicularia lescurii* Aust., Bull. Torr. Bot. Club 6:18, 1875.

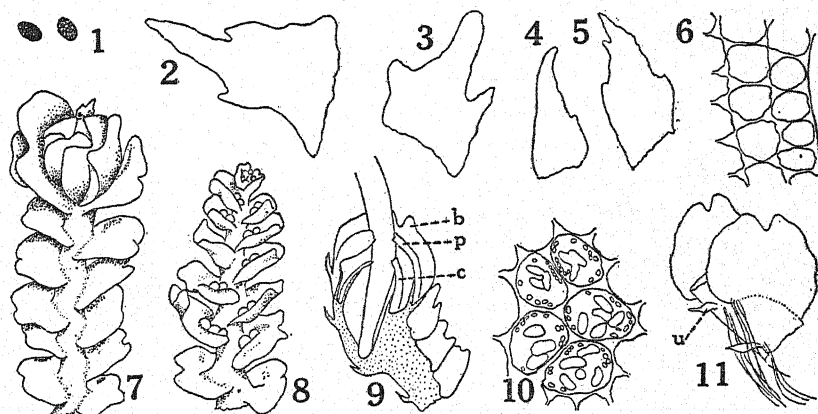
Plants more or less in mats, bright green or brownish green to deep rose; sterile shoot 0.8-1.8 mm wide. Stems 0.5-4 cm long, prostrate with more or less ascending branches; branches few, lateral. Rhizoids usually

<sup>132</sup> Under the compound microscope this row appears on the right and therefore is shown so in the figures. Over half the underleaves are so united.

<sup>133</sup> lēs kū' rī i.



numerous, in groups at the bases of the underleaves, long, colorless to brownish or faintly reddish. Leaves alternate, little to distinctly succubous, not decurrent, approximate to imbricate, spreading, simply 2-lobed, broadly orbicular, 350-900  $\mu$  long, 400-1000  $\mu$  wide, somewhat reflexed when old, the dorsal end of the insertion about the middle of the stem; margin entire to sinuate; lobes wide, rounded to obtuse at tip, often somewhat unequal with the ventral one inclined to be the larger; sinus descending  $\frac{1}{10}$ - $\frac{1}{4}$  the leaf length, acute to rounded, often gibbous. Cells of the leaf middle 24-44 by 32-56  $\mu$ , marginal row 20-33  $\mu$ , rounded to oblong-hexagonal; walls thin except for trigones, the wall along the leaf



*Nardia lescurii*. 1, Oil bodies from leaf cells,  $\times 193$ . 2-3, Underleaves of sterile stems,  $\times 37$ . 4-5, Female bracteoles,  $\times 37$ . 6, Cells along leaf margin,  $\times 193$ . 7, Tip of shoot, dorsal view, with female inflorescence,  $\times 12.7$ . 8, Tip of shoot with male inflorescence,  $\times 12.7$ . 9, Longitudinal section of perigynium showing calyptra (c), perianth (p), and female bract (b),  $\times 12.7$ . 10, Cells of the leaf middle, with large oil bodies and smaller chloroplasts,  $\times 193$ . 11, Piece of stem with underleaves (u),  $\times 198$ . (All after Taylor.)

margin little different from the others; trigones large and somewhat bulging, frequently confluent; oil bodies 2-6 per cell, round to oval or reniform, granulate, 7-10 by 10-20  $\mu$ ; cuticle smooth to verruculose. Gemmae unknown. Underleaves present throughout, often hidden by rhizoids, unlobed, triangular-subulate, acuminate to acute, entire or with one or more teeth, free or its base united with the base of a leaf. Plants unisexual; male and female plants commonly in the same mat. Male inflorescence terminal on a main shoot or on an unmodified branch, becoming intercalary with age through renewed growth at tip so that old stems may show several zones of male bracts; male bracts usually 12 but sometimes as many as 28, 2-lobed for  $\frac{1}{10}$ - $\frac{1}{4}$  the length, much like the leaves, the dorsal lobe inclined to be the larger; male bracteoles con-

stantly present, like those of sterile stems, usually united at base with one of the bracts; antheridia 2-3. Female inflorescence terminal on a main stem, frequently with innovations from beneath the perianth; female bracts larger than the leaves of sterile stems but quite similar to them; female bracteole large, free, variously toothed and sometimes 2-3-lobed. Perianth immersed, on the margin of a cup-shaped hollow in the end of the fleshy tip of the stem which later becomes the perigynium, 700-1000  $\mu$  long, inflated but somewhat dorsiventrally compressed; its cells 2-3 times as long as wide, with trigones except those near mouth; mouth shortly and widely beaked, entire, or irregularly 2-4-lobed and crenulate. Perigynium when mature nearly to quite at right angle to the direction of the stem, 700-1000  $\mu$  long, without rhizoids. Calyptra bearing old archegonia even on its top. Seta up to 900  $\mu$  long. Sporangium ovoid, 650-800  $\mu$  long, very dark brown; epidermal cells about 30 by 37  $\mu$ , with nodulose thickening; inner wall layer of cells about 18 by 60  $\mu$ , with semiannular thickenings. Elaters up to 105  $\mu$  long, 8-10  $\mu$  wide, irregularly bent, slightly attenuate at both ends; spirals 2, reddish brown. Spores 16-18  $\mu$ , finely and densely granular-papillate, dark yellowish brown. Named in honor of Leo Lesquereux, a noted bryologist, who first found it.—On wet rocks; on moist soil.

ILLUSTRATIONS: Taylor, Bryologist 42:91, figs. 1-12, 1939.

EXAMINATIONS: Ga. Tellulah Falls (Underwood 389) 1891.—Ky. Natural Bridge in Powell County (Taylor) 1925.—Ohio. Red Rock Ravines in Hocking County (Taylor) 1934.—W. Va. Hanging Rock (Ammons 548) 1929.

TYPE LOCALITY: Tellulah Falls, Georgia (Leo Lesquereux) 1850.

RANGE: Ohio (95), Ky. (218.2), W. Va. (3.2), N. C. (499.6), S. C. (499.6), Ga. (95).

We have drawn heavily upon Mrs. Taylor's excellent account of the species in Bryologist 42:85-105, 1939. It is the only account of the mature reproductive characters.

5. *Nardia breidlerii*<sup>134</sup> Lindb., Soc. Fauna Fl. Fennica, Nov. 16, 1880.

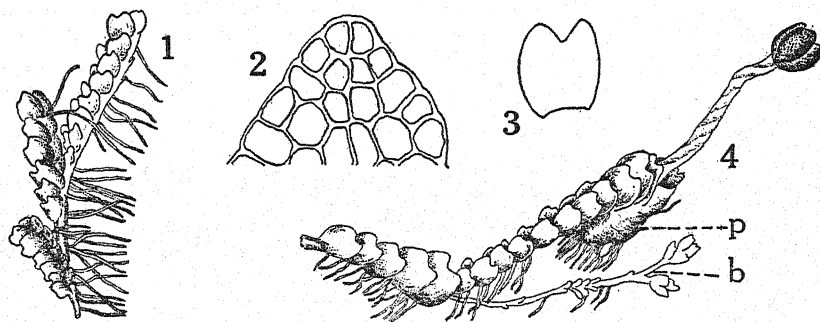
*Alicularia breidlerii* Limpr., Jahresb. Schles. Ges. Vaterl. Kult. 57:311, 1880.

*Mesophylla breidlerii* Boulay Musc. France 2:141, 1904.

Plants forming a thin mat, purplish brown. Stems 1-4 mm long, prostrate with ascending tips, simple or with few branches, often with few to many flagelliform branches. Rhizoids numerous and not in tufts, white. Leaves alternate, succubous, not decurrent, distant to somewhat overlapping, erect-spreading, simply 2-lobed, rounded to broadly oblong or ovate, concave, 160-190  $\mu$  long, about twice as wide as the stem; lobes wide, obtuse, often unequal, the dorsal usually the smaller,

<sup>134</sup> *brid' lér i.*

often somewhat connivent; sinus from barely evident to descending  $\frac{1}{8}$  the leaf length, rounded. Cells of the leaf middle 14-21  $\mu$ , of the margin 12-14  $\mu$ ; walls usually thickened, reddish; trigones wanting or small; oil bodies wanting. Underleaves toward tip only, lanceolate to subulate, small, somewhat spreading. Plants unisexual. Male plants more densely leafy; male inflorescence terminal; male bracts wide, the ventral margin often with a tooth; antheridia 1-2, large, globose, on a stalk about half as long as the body. Female inflorescence terminal or on a small short clavate branch; female bracts larger than the leaves, wider than long; bracteole oblong-ovate to lanceolate. Perianth immersed, broadly orbicular, united with the female bracts for  $\frac{1}{2}$  its length or more, the free part



*Nardia breidlerii*. 1, Sterile plant, lateral view,  $\times 17.6$ . 2, Cells of the leaf tip,  $\times 353$ . 3, Leaf, the dorsal margin at right,  $\times 7.9$ . 4, Plant with flagelliform branch (*b*), perigynium (*p*), and sporophyte,  $\times 17.6$ . (1-2, 4, after K. Mueller; 3, after Meylan.)

conical, contracted at mouth; mouth crenulate; stem saccate under the seta, fleshy, with rhizoids below. Seta 3-4 mm long. Sporangium nearly globose, about 340  $\mu$  long and 270  $\mu$  wide, reddish brown, dehiscent into 4 valves to base; wall of 2 layers of cells; epidermal layer with nodular thickenings; inner layer with semiannular thickenings. Elaters 63-84  $\mu$  long, slightly attenuate; spirals usually 3, very narrow, reddish brown. Spores 9-11  $\mu$ , smooth or granulate, reddish brown. Named in honor of Johann Breidler, who first found it.—On bare moist soil and wood.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 269; Macvicar (374) 129, figs. 1-3; Meylan (386) fig. 72.

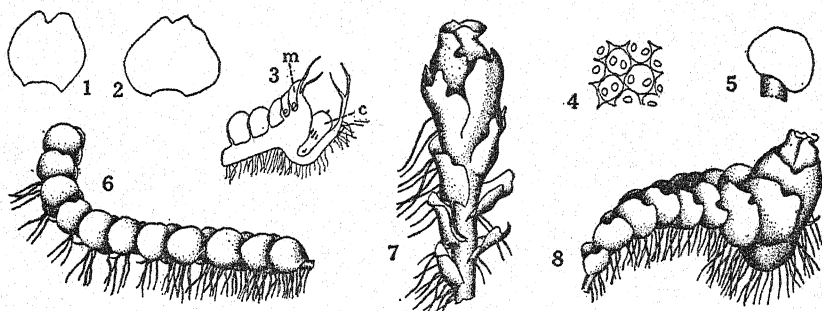
EXAMINATIONS: *Alta.* Laggan (Brinkman 681) 1913.—*Wash.* Mt. Rainier (Allen) 1900; Mt. Rainier Nat. Park (Foster 1015a) 1909.

TYPE LOCALITY: European.

RANGE: Rocky Mts. (93), Mont. (81), Alta. (50), B. C. (51), Wash. (81); Asia (350); Eur. (374).

6. *Nardia geoscyphus*<sup>135</sup> (DeNot.) Lindb. in Carr. Brit. Hep. 27, 1875.*Jungermannia scalaris* var. *minor* Nees Naturg. Eur. Leberm. 1:281, 1833.*Alicularia scalaris* var. *minor* Nees Naturg. Eur. Leberm. 2:449, 1836.*Jungermannia haematosticta* Nees Naturg. Eur. Leberm. 2:453, 1836, the name only.*Alicularia geoscyphus* DeNot., Mem. Accad. Torino, Ser. 2, 18:486, 1859.*Sarcoscyphus anomalus* Gottsche, Gottsche & Rabenh. Hep. Eur. Exsic. No. 470, 1869; according to Pearson (433).*Jungermannia silvrettae* Gottsche, Gottsche & Rabenh. Hep. Eur. Exsic. No. 470, 1869.*Marsupella silvrettae* Dum. Hep. Eur. 128, 1874.*N. repanda* Lindb., Carr. Brit. Hep. 27, 1875. Not *Jungermannia scalaris* var. *repanda* Hueben. Hep. Germ. 81, 1834.*Alicularia minor* Limpr., Cohn Krypt.-Fl. Schlesien 1:251, 1876.*N. haematosticta* Lindb. Musci Scand. 8, 1879.*N. haematosticta* var. *suberecta* Lindb. Musci Scand. 8, 1879.*Sarcoscyphus silvrettae* Steph., Bot. Ver. Landshut 7:17, 1879.*N. geoscypha* var. *suberecta* Massal. & Cares., Nuovo Giorn. Bot. Ital. 14: pl. 13, 1882.*Jungermannia dovrensis* Limpr., Jahreshb. Schles. Ges. Vaterl. Kult. 61:10, 1884.*N. minor* Arn. Leb. Stud. Nordl. Norwegen 39, 1892.*N. silvrettae* Pears. Hep. Brit. Isles 1:372, 1902.*Mesophylla minor* Bouvet, Bull. Soc. Etud. Sci. Angers 1892: 189, 1893.

Plants in rather small patches, green to reddish brown or purplish. Stem 1 cm or less long, prostrate with ascending tips, simple or rarely branched, often violet beneath. Rhizoids numerous, white or violet. Leaves alternate, succubous, not decurrent, the lower distant and sometimes retuse; upper leaves commonly imbricate, erect to spreading, usually



*Nardia geoscyphus*. 1-2, Female bracts,  $\times 6.4$ . 3, Longitudinal section through stem tip showing male (*m*) bracts and calytra (*c*),  $\times 4.2$ . 4, Leaf cells,  $\times 102$ . 5, Leaf,  $\times 7.6$ . 6, Sterile shoot,  $\times 4.2$ . 7, Erect shoot with female inflorescence,  $\times 4.2$ . 8, Prostrate plant with female inflorescence,  $\times 4.2$ . (4, after Macvicar; all others after K. Mueller.)

emarginate or rarely simply 2-lobed, orbicular, concave. Cells of the leaf middle 20-40  $\mu$ , hardly smaller toward margin; wall thin; trigones small to large, rather distinct, sometimes slightly bulging into the cells; oil

<sup>135</sup> jē ō si' fūs. According to Evans (Rhodora 9:58, 1907) the substantive form, *geoscyphus*, apparently disagreeing in gender with the genus *Alicularia* or *Nardia*, is the original, although some later writers have used the adjective form *geoscypha*, as did Carrington.



bodies 2-3 in each cell, rarely distinct, oval, rough, dull, not persistent. Underleaves rather scarce, only on upper part of fertile stems, broadly lanceolate. Plants bisexual. Male bracts emarginate, sinuate, just below the female inflorescence; antheridia usually 2, with short stalk. Female bracts almost at right angles to the stem, wider than the leaves, emarginate, sinuate-lobed or crispate-sinuate; bracteole large, irregularly 2-3-lobed. Perianth united with the bracts for  $\frac{1}{3}$ - $\frac{2}{3}$  its length, slightly shorter than the bracts; mouth contracted, crenulate to denticulate; stem tip a bulbous cup under the seta, with rhizoids at base. Seta 1-2 cm long. Sporangium broadly ovoid, reddish brown; epidermal cells with nodular thickenings; inner wall cells with semiannular thickenings. Elaters 150-200  $\mu$  long, 8-10  $\mu$  thick; spirals 2, wide, reddish brown. Spores 14-16  $\mu$ , granulate, reddish brown. Name from Gk. *geo*, earth, and *scyphus*, cup; in reference to the bulbous cup at the tip of the stem under the seta.—On old walls, banks, moors, sandy soil, rocks.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 268; Massalongo, Nuovo Giorn. Bot. Ital. 14: pl. 13, 1882; Pearson (433) 2: pl. 162; Warnstorf (523) 141, fig. 4; Macvicar (374) 128, figs. 1-3; Meylan (386) fig. 73; Jensen (323.5) 79, 2 figs.

EXAMINATIONS: *Alta.* Healy Creek (Brinkman) 1913; Jasper Park (MacFadden 337) 1926.—*Cal.* Water Wheel Trail of Tuolumne River (Sutcliffe).—*Conn.* Locality (?) (Lorenz) 1913.—*Me.* Mt. Desert (Lorenz) 1920.—*Mass.* West Newbury (Haynes 45) 1908.—*N. C.* Cascade (Schallert) 1921.—*N. H.* Lincoln (Lorenz) 1912; Mt. Washington (Evans) 1917.—*N. J.* Highlands (Haynes 1624) 1913.—*Ohio.* Red Rock Ravine in Hocking County (Taylor) 1923.—*Ore.* Ice Lake in Wallowa Mts. (Rakestraw) 1935.—*Pa.* Wilkesbarre (Lanfear 190d) 1932.—*Wash.* Mt. Baker (Grant 6570) 1927.

TYPE LOCALITY: European.

RANGE: Greenland (320), N. S. (167), Me. (369.1), N. H. (203), Mass. (90), Conn. (185), N. J. (172), Pa. (338), Ohio (95), Ky. (218.2), Ga. (504), N. C. (43), Wyo. (446), Mont. (81), Alta. (46.2), Alaska (136), B. C. (371), Wash. (81), Ore., Cal.; Eur. (103.3).

The variety *suberecta* has been reported from Nova Scotia (53.2). It does not seem worthy of varietal rank.

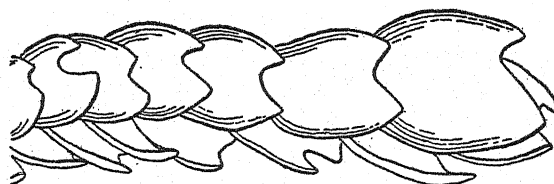
6a. *Nardia geoscyphus* var. *insecta*<sup>186</sup> (K. Muell.) Clark & Frye, Bryologist 40:15, 1937.

*N. insecta* Lindb. Musci Scand. 8, 1879.

*Alicularia geoscyphus* f. *insecta* K. Muell., Rabenh. Krypt.-Fl. 6 (1):519, 1909.  
*Alicularia geoscyphus* var. *insecta* Macvicar Stud. Handb. Brit. Hep., Ed. 2, 129, 1926.

Leaves almost all bilobed even on sterile stems. Name from L. *insecto*, to cut in; in reference to the notched leaf tips.—On banks and in wet situations.

<sup>186</sup> In sĕk' tã.



*Nardia geoscyphus* var. *insecta*. Sterile shoot, x 43. (Original, by Elizabeth Curtis.)

ILLUSTRATIONS: None.

EXAMINATIONS: Wash. Stevens Pass (Frye) 1934.—Wyo. Dinwoody Wilderness (Clayton) 1930.

TYPE LOCALITY: European.

RANGE: Wyo. (84.2); Wash. (84.2); Eur. (409).

This is not clearly differentiated from the typical *N. geoscyphus* since doubtful intergradations occur. The varietal name may, however, be useful for designating the plants with more indented leaves until we have more collections and perhaps the cause of the variation is better known.

*Plectocolea*<sup>187</sup> Mitt., in Seemann Fl. Vitiensis 405, 1871.

*Jungermannia* L. Sp. Pl. 1131, 1753, in part.

*Solenostoma* subgenus *Plectocolea* Mitt., Jour. Linn. Soc. Bot. 8:156, 1865.

*Nardia* Lindb., Acta Soc. Sci. Fennica 10:115, 1871, in part.

*Nardia* Sect. *Eucalyx* Lindb., Bot. Not. 167, 1872.

*Southbya* Husnot Hep. Gall. 15, 1875.

*Eucalyx* Breid., Mitt. Nat. Ver. Steiermark 30:291, 1894.

*Mesophylla* Corb., Revue Bryol. 31:13, 1904.

Plants in patches or mats, medium in size to rarely small, green to brown or blackish purple. Stems ascending to erect; branches none to common, arising in the ventral region of the leaf axils. Rhizoids moderately numerous, colorless or commonly brownish to purplish. Leaves alternate, succubous or on the upper part of female stems nearly transverse, distant to loosely imbricate, obovate to roundish or ovate; margin entire to sinuate. Cell walls in the leaves thin to rather thick; trigones none to large, sometimes bulging into the cell. Underleaves wanting. Plants unisexual or bisexual. Male inflorescence terminal, or in bisexual species just below the female inflorescence or farther down; male bracts saccate; antheridia 1-3 in each axil. Female bracts like the leaves, larger but the upper leaves grading into them. Perianth united for  $\frac{3}{4}$  or less of its length with the upper bracts or rarely free, immersed to  $\frac{2}{3}$ -emergent, ovoid to obovoid, contracted and plicate at tip, fleshy but not forming a bulbous or saccate perigynium. Seta of 3 layers of cells. Sporangium ovoid-globose, its wall of 2 layers of cells; epidermal cells quite

<sup>187</sup> plék" tō kō' lē ā.

large, their walls nodulose; inner layer of cells quite small, their walls with semiannular thickenings. Elaters attenuate at ends; spirals 2. Name from Gk. *plecto*, to interweave, and *koleos*, sheath; apparently in reference to the union of the female bracts with the lower part of the perianth in nearly all of the species.

Since the major division in the genus would naturally be made on the characters of reproductive organs, and these are not always present, it is believed that a comparison (see pages 320-321) is better than a key only.

1. *Plectocolea obovata*<sup>188</sup> (Nees) Mitt. in Seemann, Fl. Vitiensis 405, 1871.

*Jungermannia obovata* Nees Naturg. Eur. Leberm. 1:332, 1833.

*Jungermannia flaccida* Hueben. Hep. Germ. 87, 1834.

*Southbya obovata* Lindb., Hartm. Skand. Fl., Ed. 10, 2:130, 1871.

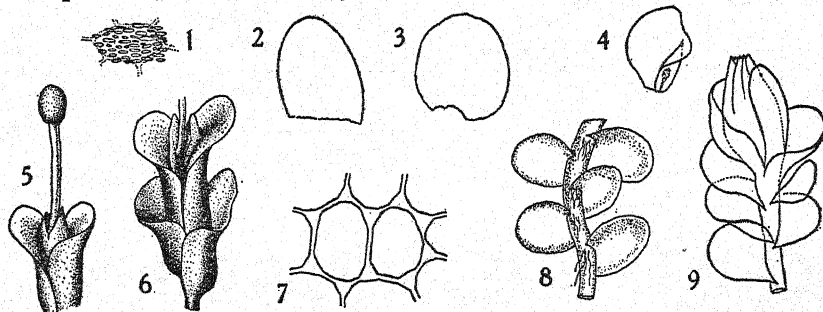
*Nardia obovata* Carr. Brit. Hep. 32, 1874-1876.

*Eucalyx obovatus* Breidl., Mitt. Naturw. Ver. Steiermark 30:291, 1893.

*Aplozia obovata* Loeske Moosfl. Harzes 59, 1903.

*Mesophylla obovata* Corb., Revue Bryol. 31:13, 1904.

Plants in patches or mats, green to reddish brown, or almost black when dry. Stem up to 5 cm long, erect to nearly prostrate, flexuous, usually simple, with sub-ventral innovations beneath the inflorescence, with flagella, the branches from the ventral region of the leaf axil. Rhizoids numerous, purplish violet, rarely colorless, the upper ones from the leaf bases. Leaves alternate, obliquely inserted or nearly transverse near perianth, succubous, slightly decurrent on dorsal side, distant at



*Plectocolea obovata*. 1, Striatulae or elongate papillae of the cuticle of the leaf,  $\times 146$ . 2, Female bract,  $\times 8.5$ . 3, Leaf,  $\times 6.5$ . 4, Male bract,  $\times 12.7$ . 5, Tip of shoot with sporophyte,  $\times 6.5$ . 6, Tip of shoot with sporophyte,  $\times 7.9$ . 7, Cells of the leaf middle,  $\times 307$ . 8, Part of shoot, ventral view,  $\times 8.5$ . 9, Tip of shoot with perianth,  $\times 8.5$ . (1, after Jensen; 2, 4, 8-9, after Pearson; 3, 5-6, after K. Mueller; 7, original, by Elsie K. Waddingham.)

base of stem, almost to quite imbricate near tips, spreading, ovate to obovate, quite concave at leaf base, 600-800  $\mu$  long, 500-700  $\mu$  wide; apex rounded to emarginate; margin entire. Cells of the leaf middle 30-45  $\mu$

<sup>188</sup> ob o vā' tā.

PLECTOCOLEA	1	2
	<i>obovata</i>	<i>fossom- bronioides</i>
1. Plants bisexual, <del>unisexual</del> .....	b	b
2. Male inflorescence terminal, just below the female one, or farther down the stem.....	b	b
3. Trigones none, small, large, bulging, very, moderately .....	s	s
4. Mouth of the perianth crenulate, denticulate, lobed, lacinate, ciliate .....	(2-3)b	n±d
5. Rhizoids colorless or with age becoming purplish, reddish, brown(ish), yellowish.....	p	p
6. Leaves near female inflorescence inclined to be retuse .....	+	+
7. Cells of the leaf middle in $\mu$ .....	30-45	31-36
8. Cuticle of the leaves punctate, verruculose, smooth, striate, minutely .....	p-t	s
9. The fraction of the perianth united with the bracts .....	$\frac{1}{2}$	$\frac{1}{4}$
10. Form of perianth—conical, ovoid, campanulate, oblong, obovoid, sub-.....	c	sm
11. Leaves quite undulate.....	—	—
12. Marginal row of leaf cells in the same plane as the others or more adaxial.....	m	m
13. Perianth immersed, what fraction emergent.....	i- $\frac{1}{2}$	$\frac{1}{2}$ - $\frac{2}{3}$
14. Marginal row of leaf cells how many times the area of the second row.....	.7-1	.7-1
15. At least the marginal wall of the marginal row of leaf cells thicker.....	—	—
16. Ridges of the perianth tuberculate, crenulate, smooth .....	s	s-c

in longest diameter, of the margin 18-20  $\mu$ , of the base about 36 by 96  $\mu$ , 4-6-angled; walls thin; trigones small, distinct; oil bodies small, 3-5 in each cell, nearly spherical, smooth; cuticle punctate to coarsely striate. Underleaves none except in association with the bracts, rounded at apex, margin entire. Plants bisexual; the leaves grading into the larger bracts. Male bracts below the female ones, concave, widest near base, usually with 2 antheridia. Female inflorescence terminal on a main stem or large



3 <i>subellip- tica</i>	4 <i>obscura</i>	5 <i>crenulata</i>	5a var. <i>crisulata</i>	5b var. <i>gra- cillima</i>	6 <i>rubra</i>	7 <i>cremuli- formis</i>	8 <i>hyalina</i>
b	u	u			u	u	u
b	t	t-f			t	f	t
s	vs	s-n			ml-b	ml	ml
c	c-l	(4-5) d- (c-l)			d	c	c
b	p	yb			c	p-r	r
-	-	+			-	+	+
20-30	20-35	30-40			20-50	25-27	25-36
s-v	s-tv	mp			p	s	s
$\frac{1}{2}$ - $\frac{3}{4}$	$\frac{1}{4}$ - $\frac{3}{4}$	0- $\frac{1}{4}$			$\frac{1}{4}$ - $\frac{2}{5}$	$\frac{1}{4}$ - $\frac{1}{2}$	$\frac{1}{4}$
c-o	c	o-b			o-b	d	o
-	-	-			-	-	+
m	m	m			m	a	m
i- $\frac{1}{6}$	i- $\frac{1}{6}$	$\frac{1}{8}$ - $\frac{1}{2}$			$\frac{1}{2}$ - $\frac{2}{3}$	i- $\frac{1}{6}$	$\frac{2}{5}$ - $\frac{1}{2}$
1	1	2-3	2-3	1-1.5	1.5-2	1-1.3	1
-	-	+	+	-	-	+	-
s	s	s-c	t	s-c	s	s	s

branch; bracts saccately concave, erect with the upper  $\frac{1}{3}$  spreading to squarrose. Perianth united with the bracts for about half its length, about equalling the bracts in length; its free portion narrowly conic, 4-6-plicate; mouth 2-3-lobed. Seta 1-2 cm long. Sporangium ovoid-globose, dark brown, of 2 layers of cells; epidermal layer of cells quadratic, 3-4 times as large as the inner, their walls with nodular thickenings; inner layer of cells narrow, rectangular, with semiannular

thickenings; elaters brown; spirals 2; spores 16-21  $\mu$ , granular-papillate, yellowish brown. In the original description Nees describes the perianth as obovate to subclavate; the species name may be in reference to this.—On wet rocks in shade, in subalpine regions.

ILLUSTRATIONS: Evans, *Rhodora* 21: 165, figs. 10-14, 1919; K. Mueller (409) 1: fig. 270; Carrington, *Brit. Hep. pl.* 11, fig. 35, 1874-1876; Macvicar (374) 135, figs. 1-3; Gil (76) fig. 212; Meylan (386) fig. 76.

EXAMINATIONS: *Alaska*. Juneau (Mehner) 1904.—*Ind.* Turkey Run State Park (Drexler 1421 in part) 1938, and (1733) 1939.—*Me.* Mt. Katahdin (Lorenz) 1916.—*Newfoundland*. Mt. Sykes (Northrup 16 in part) 1911.—*N. H.* (Underwood) 1889.—*Wash.* Darrington (Frye) 1928; Hamilton (Foster) 1905.

TYPE LOCALITY: Giant Mountains of Silesia and Bohemia.

RANGE: Greenland (320), Newfoundland, N. S. (53.2), Me. (333), N. H. (491), Vt. (203), Md. (444), Ind., Mont. (81), Alta. (51), Alaska (491), B. C. (313), Wash. (81), Ore., Cal. (296); S. Amer. (191); Eur. (325).

Evans (191) (202) considers the occurrence in Colombia, in Alaska and in California as rather doubtful.

Submerged plants are sometimes referred to as var. *rivularis* Schiffn. (Lotus 1:5 of reprint, 1905). This seems to be merely a form due to submergence. It is longer, with rhizoids fewer, with leaves and their cells larger, with their cell walls thinner and the trigones less developed. This form has been reported from Vermont (193) and Europe (191).

2. *Plectocolea fossombronioides*<sup>189</sup> (Aust.) Mitt. Trans. Linn. Soc. Bot., Ser. 2, 3:198, 1891.

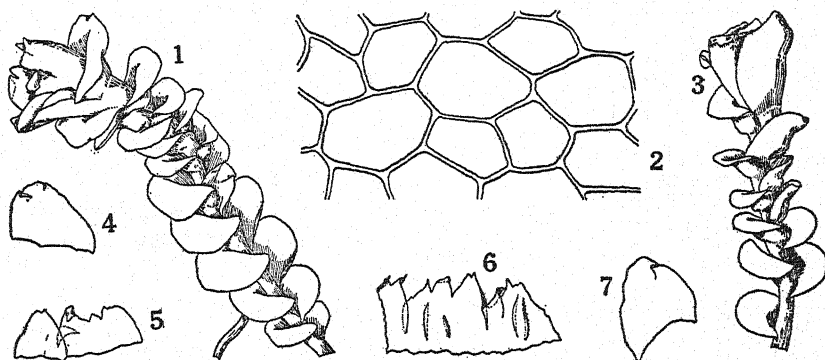
*Jungermannia fossombronioides* Aust., Proc. Acad. Nat. Sci. Philadelphia 21(1869):220, 1870.

*Nardia fossombronioides* Lindb., Acta Soc. Sci. Fenn. 10:529, 1875.

Plants in dense patches. Stems up to 3 cm long, prostrate with ascending tips, branched, without subfloral innovations; branches intercalary, largely flagelliform or longly stoloniform. Rhizoids numerous along the stem to quite near the tip, purplish, often tending to form a ventral longitudinal row. Leaves alternate, distant and somewhat succubous on lower part of stem, imbricate and nearly transverse on upper part, clasping the stem, spreading to squarrose, hollowed and usually narrower at base, hardly 2-lobed, ovate to subrotund; apex rounded to retuse; margin entire to slightly sinuose. Cells of leaf middle about 31-36  $\mu$ , of the margin about 23  $\mu$ ; trigones small but distinct; marginal row of cells a shade smaller or quite the same in area as the second row, with walls the same thickness or apparently slightly thicker on account of less space between the trigones; cuticle smooth. Underleaves wanting. Plants bisexual. Male

<sup>189</sup> fös süm brö" nī öid' ës.

inflorescence just below the female or sometimes the plant continuing vegetatively above the male inflorescence; male bracts normally 6-12, usually widely spread from saccate base, the apical part sometimes reflexed. Perianth united with the bracts for about  $\frac{1}{4}$  its length or usually only with the upper one, large, most of it emergent; the free portion



*Plectocolea fossombronioides*. 1, Shoot with perianth,  $\times 7.9$ . 2, Cells of the leaf middle,  $\times 520$ . 3, Tip of plant with perianth,  $\times 7.9$ . 4, Female bract,  $\times 7.9$ . 5-6, Mouth of perianth,  $\times 7.9$ . 7, Female bract,  $\times 7.9$ . (1, 3-7, after Evans; 2, original, by Elizabeth Curtis.)

6-10-plicate, subcampanulate, often incomplete or abnormal in form; its cells various, usually some of them elongate, but often those of the neck isodiametric; mouth deeply lacinate, usually widely open; its lacinae irregular in number as well as in size and form, from slightly involute to erect or revolute, entire to vaguely crenulate with projecting cells or minutely and irregularly toothed. Calyptra violet. Seta in cross section of 2 circles of 24 and 18 cells respectively, and an inner group of 11 cells. Sporangium shortly ovoid. The name from the resemblance to *Fossombronia*, apparently from the commonly wide mouth of the perianth.—On rocks along rivulets.

ILLUSTRATIONS: Evans, *Bryologist* 22:60, figs. 1-7, 1919; Ammons (2.1) 143, fig. C.

EXAMINATIONS: Conn. Washington (Evans) 1921.—D. C. Washington (Evans) 1905.—N. C. Durham (Blomquist) 1923; Winston-Salem (Schallert 1984) 1920.—Ohio. Little Rocky Ford in Hocking County (Taylor) 1924.

TYPE LOCALITY: Near Closter, New Jersey (C. F. Austin).

RANGE: Conn. (203), Ohio, Ill. (193), N. C. (43), W. Va. (190), D. C., N. J. (506).

The plant has been reported from Macon, Georgia (Underwood & Cook Hep. Amer. Exsic. No. 39). However the material is sterile and Evans (190) doubts the determination.

3. *Plectocolea subelliptica*<sup>140</sup> (Lindb.) Buch, Evans & Verdoorn, Ann. Bryol. ogici 10 (1937) :4, 1938.

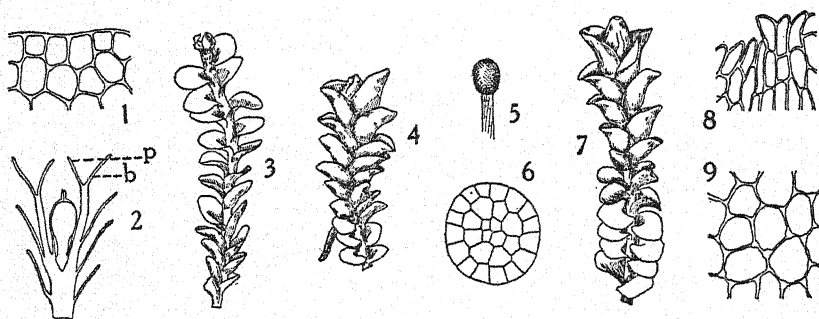
*Nardia subelliptica* Lindb., Medd. Soc. Fauna Fl. Fennica 4:182, 1883.

*Eucalyx subellipticus* Breidl., Mitt. Naturw. Ver. Steiermark 30: 291, 1893.

*Southbya subelliptica* Lett. List Spec. Hep. Brit. Isles 140, 1902.

*Haplozia subelliptica* Gil Fl. Iberica, Hep. 424, 1919.

Plants in patches or among mosses, yellowish green or brownish. Stems 3-10 mm long, ascending to suberect, flexuous or arcuate, branched. Rhizoids numerous, hyaline to brownish or pale reddish. Leaves alternate, succubous, nearly transversely inserted on upper part of stem, not decurrent, the lower distant and spreading, the upper subimbricate and erect-spreading, unlobed, somewhat secund on the dorsal side of the plant, broadly oval, concave, the upper the larger; apex rounded; margin entire, incurved. Cells of the leaf middle 20-30  $\mu$ , of the margin 18-20  $\mu$ ,



*Plectocolea subelliptica*. 1, Cells along leaf margin, x 140. 2, Longitudinal section of female inflorescence with perianth (*p*), and bract (*b*), x 13.2. 3, Dorsal view of sterile shoot, x 7.9. 4, Dorsal view of shoot with perianth, x 7.9. 5, Unruptured sporangium, x 21. 6, Cross section of young seta, x 106. 7, Dorsal view of shoot with perianth, x 7.9. 8, Part of mouth of perianth, x 106. 9, Cells of the leaf middle, x 140. (1-4, 6-9, after Evans; 5, after K. Mueller.)

round-hexagonal or the marginal ones subquadrate; walls thin; trigones small, often indistinct; oil bodies spherical, of warty appearance; cuticle smooth or finely verruculose. Underleaves wanting. Plants bisexual. Male bracts below the female ones on the same branch or the two on different branches, with upper part strongly recurved; antheridia usually 2, ovoid-globose, on short stalk. Female bracts larger than the leaves but grading into them, erect-patent, broadly oval to roundish-ovate, saccate at base, undulate, erect to squarrose at apex. Perianth united with the bracts for  $\frac{1}{2}$ - $\frac{3}{4}$  its length, about as long as the female bracts; the free portion broadly conical to ovoid, plicate, at ripening of spores splitting into 3-4 triangular segments from the tip back; mouth crenulate, not

<sup>140</sup> sūb ēl līp' tī kă.



lobate. Seta 150  $\mu$  thick, in cross section of 3 layers of 4, 8, and 16 cells respectively. Sporangium globose, dark brown, opening by 4-8 valves, its wall composed of 2 layers of cells; epidermal cells 3-4 times as wide as those of the inner layer, quadratic, plate-like, with nodular thickenings; cells of the inner layer very narrow, rectangular, with semiannular thickenings. Elaters about 100  $\mu$  long and 8  $\mu$  thick, with attenuate ends; spirals 2, lax, reddish brown. Spores 12-14  $\mu$ , reddish brown. The name from the somewhat elliptical leaves.—On moist soil and rocks.

ILLUSTRATIONS: Evans, *Bryologist* 22:70, figs. 8-15, 1919; K. Mueller (409) 1: fig. 271; Meylan (386) fig. 77; Macvicar (374) 136, figs. 1-4.

EXAMINATIONS: None.

TYPE LOCALITY: Kongsvold, near Dovre, Norway (S. O. Lindberg) 1882.

RANGE: Greenland (53.2), N. S. (190); Iceland (53.1); Eur. (409).

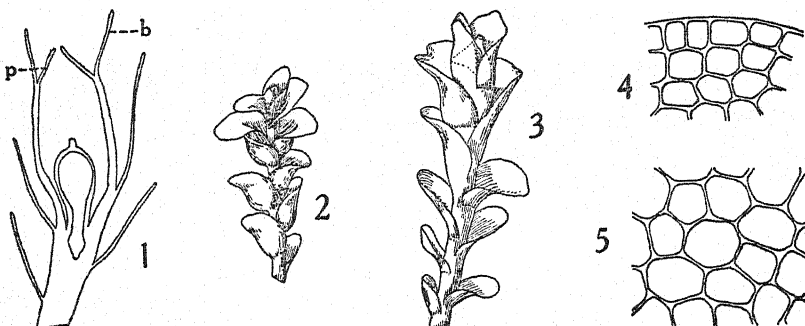
Stephani (491) 2:65, 1901, merges this plant with *Nardia obovata*. If the characters distinguishing it from *N. obovata* are fixed they seem to us to be of specific importance.

4. *Plectocolea obscura*<sup>141</sup> Evans in Buch, Evans & Verdoorn, *Ann. Bryologici* 10(1937):4, 1938.

*Nardia obscura* Evans, *Rhodora* 21:159, 1919.

Plants in more or less compact mats, bright green to deeply blackish purple. Stems 1-2 cm long, 200-450  $\mu$  thick, the older portions prostrate and closely adherent to the substratum, sparingly branched, without subfloral innovations; branches intercalary, arising just above the ventral base of the leaf, sometimes leafy, often slender stolons. Rhizoids usually numerous on the prostrate stems and stolons, rare elsewhere, hyaline to deeply purple, not forming ventral tufts. Leaves alternate, succubous but nearly transverse toward inflorescence, dorsally and sometimes ventrally decurrent, distant to loosely imbricate, spreading to erect-spreading, unlobed or rarely barely 2-lobed, broadly ovate to orbicular, mostly 0.9-1.5 mm long and 0.75-1.5 mm wide; apex rounded to rarely retuse; margin entire, not bordered with different cells. Cells of the leaf middle 25-35  $\mu$  long and 20-28  $\mu$  wide, of the margin 15-20  $\mu$ ; walls thin; trigones minute; cuticle smooth to delicately striate-verruculose. Underleaves wanting. Plants unisexual. Male plants sometimes in the same patch as the female; male bracts mostly 4-12, imbricate, deeply saccate, the dorsal part usually a little smaller than the ventral but sometimes equalling it or larger; antheridia 1-2. Female bracts larger than the leaves but grading into them, slightly wider, more undulate, more inclined to be retuse at tip. Perianth united with the bracts for  $\frac{1}{2}$ - $\frac{3}{4}$  its length, 1.5-2 mm long,

<sup>141</sup> öb skü' rä.



*Plectocolea obscura*. 1, Longitudinal section of female inflorescence showing perianth, (p), and female bract (b), x 17.6. 2, Male inflorescence, x 10.6. 3, Tip with perianth, x 10.6. 4, Cells along leaf margin, x 187. 5, Cells of leaf middle, x 187. (All after Evans.)

0.7-1 mm wide, immersed or barely emergent; free part conical, regularly plicate above, its cells more or less elongate; mouth minutely crenulate to shortly ciliolate by projecting cells. Sporophyte unknown. Perhaps so named from the almost hidden perianth.—On steep damp rocks, usually in shaded ravines.

ILLUSTRATIONS: Evans, *Rhodora* 21: pl. 126, 1919; Sanborn, Univ. Oregon Publ. Pl. Biol. 1 (1): pl. 2, figs. 2-4, 1929.

EXAMINATIONS: Conn. Beacon Falls (Evans) 1905; Salisbury (Lorenz) 1920.—N. H. Tylers Spring near Waterville (Lorenz) 1907.

TYPE LOCALITY: The "V," Waterville, New Hampshire (Lorenz 203).

RANGE: Me. (369.1), N. H. (191), Vt. (191), Mass. (191), Conn. (191), Ore. (457).

The occurrence of this plant at Coos Bay on the Oregon coast is very interesting and points chiefly to the need for comparative study of the Pacific Coast material of *Nardia*. Since the Coos Bay climate is very like that of the coast from Eureka, California, to Vancouver Island, B. C., this species has probably been gathered and called something else.

5. *Plectocolea crenulata*<sup>142</sup> (Sm.) Buch, Evans & Verdoorn, Ann. Bryologici 10(1937):4, 1938.

*Jungermannia crenulata* Sm. in Sowerby Eng. Bot. pl. 1463, 1805.

*Solenostoma crenulatum* Mitt., Jour. Linn. Soc. London 8:51, 1865.

*Nardia crenulata* Lindb., Bot. Not. 167, 1872.

*Aplozia crenulata* Dum. Hep. Eur. 57, 1874.

*Southbya crenulata* Bernet Cat. Hep. Suisse 55, 1888.

*Mesophylla crenulata* Corb., Revue Bryol. 31:39, 1904.

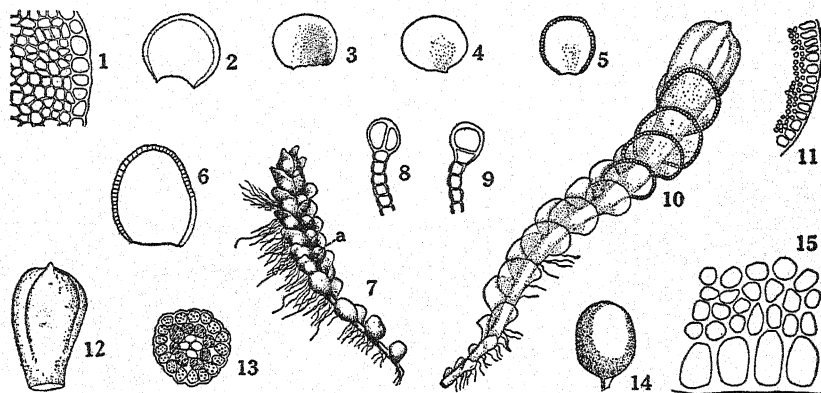
*Eucalyx crenulatus* Loeske, Hedwigia 49:8, 1909.

*Haplozia crenulata* K. Muell., Rabenh. Krypt.-Fl. 6(1):539, 1909.

Plants in thin compact patches, green or usually brownish red. Stem up to 12 mm long, prostrate with ascending tips, flexuous, usually brown on the ventral side, commonly branched, often with several small-leaved

<sup>142</sup> krĕn ū lă' tă.

innovations. Rhizoids numerous, hyaline or brownish yellow. Leaves alternate, the lower succubous, the upper larger and nearly or quite transversely inserted, not or slightly decurrent, closely imbricate at least on upper part of stem, erect to spreading and somewhat secund, not lobed, orbicular; apex rounded; margin entire. Cells of the leaf middle about  $30-40\ \mu$ , near margin  $18-20\ \mu$ , of the base about  $30$  by  $50\ \mu$ ; walls thin; trigones none or rarely small; marginal row of cells about  $30\ \mu$ , quadrate, about 2-3 times as large in area as the second row, thicker walled, in the same plane as the ordinary leaf cells, forming a distinct border; oil bodies



*Plectocolea crenulata*. 1, Leaf cells,  $\times 85$ . 2, Leaf,  $\times 15.2$ . 3-5, Leaves,  $\times 10.2$ . 6, Female bract,  $\times 10.2$ . 7, Male shoot with antheridia (a),  $\times 11.6$ . 8-9, Cross section through margin of female bract,  $\times 89$ . 10, Shoot with perianth,  $\times 10.2$ . 11, Cells at leaf margin,  $\times 36$ . 12, Perianth,  $\times 20$ . 13, Cross section of seta,  $\times 44$ . 14, Antheridium,  $\times 72$ . 15, Cells along margin of leaf,  $\times 80$ . (1-2, 7, 9, after K. Mueller; 8, after Duin; the others after Pearson.)

ovoid, distinct, 2-3 per cell; cuticle finely punctate. Underleaves wanting. Plants unisexual. Male plants more slender; bracts 6-16, at middle or apex of stem, transversely inserted, imbricate, ventricose; antheridia 1-2. Female bracts larger than the leaves, erect. Perianth  $\frac{1}{3}$ - $\frac{1}{2}$ -emergent, usually united with the bracts, ovoid to narrowly oblong, mostly tinged with red, slightly laterally compressed, 4-5-plicate, contracted at mouth but rarely forming a tube; the ridges prominent, smooth to crenulate, extending almost to base; mouth with 4-5 triangular teeth; these teeth roughened by mostly unicellular projections which form more or less of a plug closing the mouth before the sporophyte opens it. Seta 4-9 mm long; in cross section composed of 3 concentric circles of cells; the number of cells of the inner circle 4, of the middle 8-12, of the outer 16-18. Sporangium short-ovoid, brown; radial walls of the epidermal cells with nodular thickenings; inner layer of wall cells with semiannular thickenings. Elaters

6-7  $\mu$  thick; spirals 2, dark reddish brown. Spores 12-18  $\mu$ , finely granulate, reddish brown. So named from the crenulate folds of the perianth.—On moist soil, sand or banks; along ditches.

ILLUSTRATIONS: Smith, in Sowerby Eng. Bot. pl. 1463, 1805; Pearson (433) 2: pl. 127; K. Mueller (409) 1: fig. 274, b-e; Warnstorf (523) 154, fig. 4, a-e; Macvicar (374) 141, figs. 1-3; Meylan (386) fig. 79; Gil (76) figs. 213-214; Underwood (506) pl. 25; Ekart (124) pl. 12 (Add. to 3), fig. 25; Schiffner (458) fig. 42, A-B; Evans, Bryologist 22: pl. 2, fig. 8, 1919; Douin, Bull. Soc. Bot. France 55: pl. 6, fig. 8, 1908; Ammons (3.1) 143, fig. A.

EXAMINATIONS: D. C. Washington (Waite 521) 1889.—Me. Prospect Harbor (Northrup) 1902.—Mass. Amesbury (Huntington 5) 1901; West Newbury (Haynes 653) 1904.—N. H. Randolph in Coos County (Evans) 1917.—N. J. Highlands in Monmouth County (Haynes 809) 1904.—Pa. Meadville (Clarke 633) 1921.—S. C. Summerville in Berkley County (Haynes 1353) 1911.—W. Va. Dellslow (Sheldon 4026) 1910; Renceverle (Gray 134) 1923.

TYPE LOCALITY: British Isles.

RANGE: Greenland (325), N. S. (431), N. B. (369), Me. (369.1), N. H. (140), Vt. (142), Mass. (7), R. I. (140), Conn. (140), N. Y. (504), Que. (178), Pa. (237), Ont. (53.2), Ind. (512.1), Wis. (98), Ky. (218.2), Tenn. (464), Ala. (498), Fla. (337), Ga. (52), S. C. (43), N. C. (43), W. Va. (2.1), Md. (444), D. C. (282), N. J. (28); Asia (325); Iceland (350.1); Eur. (386); Azores (325); Africa (101.1).

According to Evans (202) material of *P. crenulata* reported from the Pacific Coast should be referred to *P. rubra*.

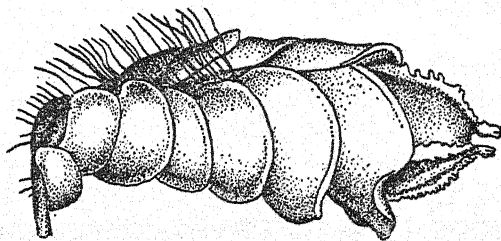
5a. *Plectocolea crenulata* var. *cristulata*<sup>143</sup> (Dum.) n. comb.

*Aplozia cristulata* Dum. Hep. Eur. 57, 1874.

*Aplozia crenulata* var. *cristulata* Massal., Ann. Instit. Bot. Roma 2(2):20, 1886.

*Haplozia crenulata* var. *cristulata* K. Muell., Rabenh. Krypt.-Fl. 6(1):542, 1909.

Flagellate branches often wanting. Ridges of the perianth with distinct and high tubercles which extend down about as far as the perianth is exerted. Name from *L. cristulatus*, having a small comb; in reference to the tuberculate ridges of the perianth.—On moist soil.



*Plectocolea crenulata* var. *cristulata*. Tip of plant with perianth,  $\times$  about 21. (After K. Mueller.)

<sup>143</sup> krīs tū lā' tā.



ILLUSTRATIONS: K. Mueller (409) 1: fig. 275.

EXAMINATIONS: None.

TYPE LOCALITY: Germany.

RANGE: Greenland (409); North America (409); Japan (409); Eur. (120).

5b. *Plectocolea crenulata* var. *gracillima*<sup>144</sup> (Sm.) n. comb.

*Jungermannia gracillima* Sm. in Sowerby Eng. Bot., pl. 2238, 1805.

*Jungermannia crenulata* var. *gracillima* Hook. Brit. Jung. pl. 37, 1816.

*Jungermannia genthiana* Hueben. Hep. Germ. 107, 1834.

*Aplozia gracillima* Dum. Hep. Eur. 57, 1874.

*Nardia gracillima* Lindb., Acta Soc. Sci. Fennica 10:530, 1875.

*Jungermannia crenulata* var. *genthiana* Limpr., Cohn Krypt.-Fl. Schlesien 1:269, 1876.

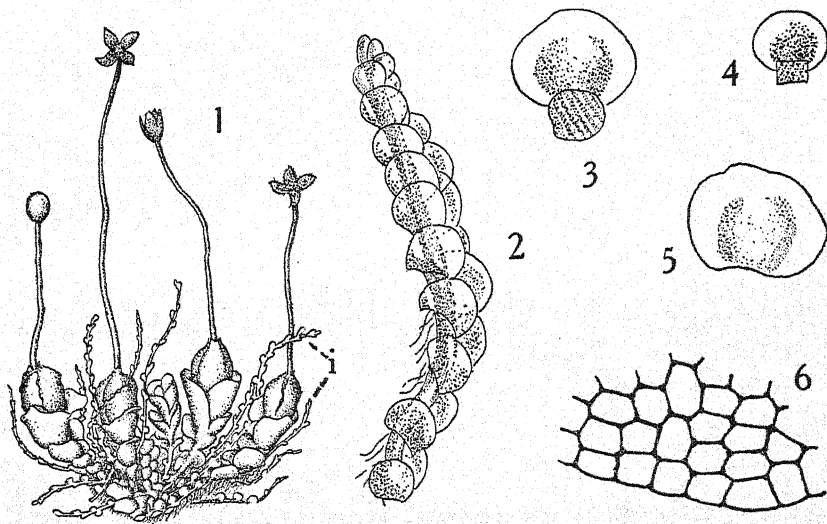
*Nardia crenulata* var. *gracillima* Lindb. Musci Scand. 8, 1879.

*Aplozia crenulata* var. *gracillima* Heeg, Verh. Zool.-Bot. Gesell. Wien 43:81, 1893.

*Eucalyx gracillimus* Loeske, Hedwigia 49:9, 1909.

*Haplozia crenulata* f. *gracillima* K. Muell., Rabenh. Krypt.-Fl. 6(1):542, 1909.

Plants smaller than in the type, green or reddish. Stems with numerous innovations with small distant leaves. Marginal row of leaf cells thin walled, not or hardly larger than the cells of the second row, not forming a border or merely an indistinct one in occasional leaves. Female bracts with a distinct border. Perianth with angles smooth or nearly so. Calyptra rose colored. Name from *L. gracillimus*, very slender; re-



*Plectocolea crenulata* var. *gracillima*. 1, Plant with sporophytes and innovations (*i*), x 5. 2, Sterile shoot, x 22. 3-4, Leaves, x 17. 5, Female bract, x 17. 6, Cells near tip of stem leaf, x 187. (1, after K. Mueller; 2-5, after Pearson; 6, after Evans.)

<sup>144</sup> gră sil' li mă.

ferring to its numerous slender innovations.—On moist banks and borders of trodden paths, growing intermingled with the type.

ILLUSTRATIONS: Pearson (433) 2: pl. 128; Smith, in Sowerby Eng. Bot. pl. 2238, 1805; Hooker (285) pl. 37; Macvicar (374) 142, figs. 1-4; Warnstorf (523) 154, fig. 4, f-g; K. Mueller (409) 1: fig. 274, a; Evans, Bryologist 22: pl. 2, fig. 9, 1919.

EXAMINATIONS: None.

TYPE LOCALITY: British Isles.

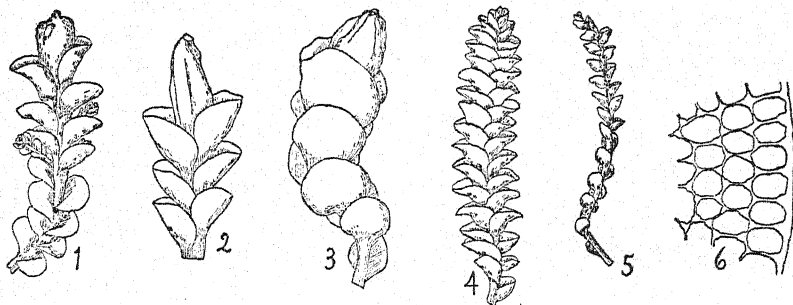
RANGE: N. J. (28), Ga. (52); Eur. (19).

6. *Plectocolea rubra*<sup>145</sup> (Underw.) Buch, Evans & Verdoorn, Ann. Bryologici 10(1937):4, 1938.

*Jungermannia rubra* Underw., Bot. Gaz. 13:113, 1888; also Gottsche, in Bolander, California Med. Gaz. 1870:184, 1870, the name only.

*Nardia rubra* Evans, Bryologist 22:62, 1919.

Plants in thin mats, green to reddish green. Stems 3-12 mm long, 300-350  $\mu$  thick, prostrate or the tip ascending, simple or laterally branched. Rhizoids numerous, long, hyaline. Leaves alternate, succubous, the upper nearly transverse, slightly or not at all decurrent, distant below to imbricate especially upward, not lobed, rounded to ovate, on sterile stems 350-790  $\mu$  long, on fertile stems 0.5-1.3 mm long and 0.6-1.5 mm wide, reddish or red, distinctly margined by a row of larger cells with thick walls; apex rounded; margin entire. Cells of the leaves 20-50



*Plectocolea rubra*. 1-3, Plants with perianth,  $\times 7.5$ . 4-5, Male plants, dorsal view,  $\times 7.5$ . 6, Cells along margin near tip of leaf,  $\times 132$ . (All after Clark & Frye.)

$\mu$ ; walls thick; trigones distinct; cuticle punctate. Underleaves wanting. Plants unisexual. Male inflorescence terminal; male bracts 6-20; antheridia 2, ovoid, with short stalk, with few paraphyses. Female bracts larger than the leaves of sterile stems; their margins thickened, entire. Perianth with the lower part united with the female bracts,  $\frac{1}{2}$ - $\frac{2}{3}$ -emergent, red to purple, 2 cells thick below and 1 above, plicate; mouth

<sup>145</sup> rü' brä.

abruptly contracted to a short beak, at first denticulate, later lacerate. Seta quite long, of 3 layers of about 6, 9, and 19 cells respectively. Sporangium ovoid, dark brown, split into 4 elliptical valves to base, the wall of 2 layers of cells; epidermal cells about  $27 \times 21 \mu$ ; cells of the inner wall layer  $30-36 \mu$  long,  $9-13 \mu$  wide. Elaters  $90-130 \mu$  long, attenuate at both ends; spirals 2, brown. Spores  $13-16 \mu$ , very finely granulate, brown. Name from *L. ruber*, red; reference to the usual color of the plant.—On moist banks of sand or clay, or on sandstone.

ILLUSTRATIONS: Evans, *Bryologist* 22: pl. 2, figs. 1-7, 1919; Underwood, *Bot. Gaz.* 13: pl. 4, 1888; Clark & Frye (81) 63, figs. 1-6.

EXAMINATIONS: *Alta.* Seeber (Brinkman 3582) 1928.—*Cal.* Bolinas in Marin County (Setchell); San Andreas (Howe) 1895; San Mateo County (Bradshaw 3175) 1923.—*Ore.* Cape Arago (Frye) 1922; Cornell Road (Potter 15) 1921; Hemlock (Rakestraw) 1937; Oakland (Hunt) 1913.—*Wash.* Aberdeen (Foster 932) 1909; Bowmans Creek in Clallam County (Svihla 257) 1931; Issaquah (Frye) 1908; North Bend (Frye) 1926; Pacific Beach (Foster 1500) 1911.—*Wyo.* Firehole River in Yellowstone National Park (Rakestraw) 1934.

TYPE LOCALITY: Mendocino County, California (Henry N. Bolander).

RANGE: Wyo., Mont. (81), Alta. (50), B. C. (190), Ida. (81), Wash. (81), Ore. (457), Cal. (844).

7. *Plectocolea crenuliformis*<sup>146</sup> (Aust.) Mitt., *Trans. Linn. Soc. Bot.* Ser. 2, 3:198, 1891.

*Jungermannia crenuliformis* Aust., *Bull. Torr. Bot. Club* 3:10, 1872.

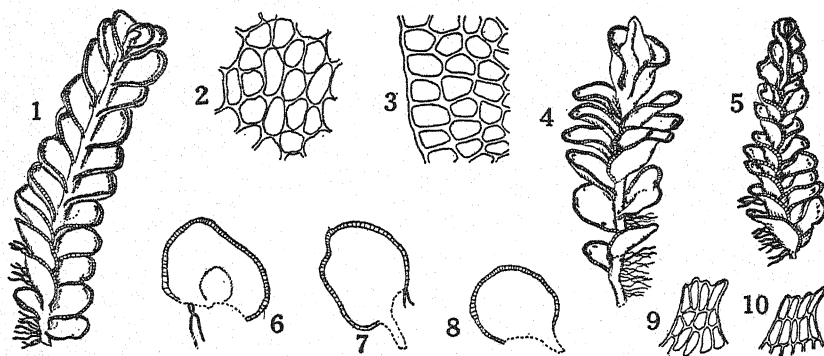
*Nardia crenuliformis* Lindb., *Acta. Soc. Sci. Fennica* 10:529, 1875.

*Solenostoma crenuliformis*<sup>147</sup> Steph., *Bull. Herb. Boissier* Ser. 2, 2:494, 1901; also *Sp. Hep.* 2:56, 1901.

Plants in dense patches, brownish. Stems up to 2.5 cm long, prostrate, the sterile with ascending leafy shoots, attenuate at tip, or when fertile gradually wider upward, with numerous flagelliform branches. Rhizoids numerous, purplish or reddish. Leaves alternate, succubous on lower stem, transverse above, slightly decurrent dorsally, imbricate, obliquely spreading, hardly 2-lobed, orbicular, concave; apex rounded to retuse; margin entire or slightly sinuous; the marginal row of cells a little larger than the second row, with slightly thicker walls, slightly shifted toward the ventral side from the plane of the other leaf cells and thus forming a raised leaf edge on that side. Cells of the leaf middle and also of the margin  $25-27 \mu$ , quadrate, of the base about  $27$  by  $37 \mu$ ; trigones distinct, those near margins less so; marginal row 1-1.3 times the diameter of second row, walls of marginal row 1-4 times as thick as those of second row. Underleaves wanting. Plants unisexual. Male

<sup>146</sup> *krén' ū lī fōrm' is.*

<sup>147</sup> To make the species agree in gender with the genus, Evans (155) writes the name *S. crenuliforme*.



*Plectocolea crenuliformis*. 1, Sterile shoot, x24. 2, Median leaf cells, x303. 3, Cells along the leaf margin, x303. 4, Shoot with perianth, x24. 5, Male inflorescence, antheridia not shown, x24. 6, Male bract, x42. 7, Female bract, x42. 8, Leaf, x42. 9-10, Lobes of the mouth of the perianth, x303. (All after Lorenz.)

plants more slender; male inflorescence not apical but farther down the stem; bracts 10-14, imbricate, saccate. Female stems densely foliate; female bracts larger than the leaves of sterile stems. Perianth subobovoid, small, more or less united with the female bracts, immersed to slightly emergent, rhizoidous at base, 3-angled toward mouth, becoming 4-7-plicate, the tip rounded to truncate; mouth constricted, shortly beaked, crenulate. Calyptra often violet purplish. Sporangium ovoid-globose. So named from its similarity to *N. crenulata*.—On rocks along streams.

ILLUSTRATIONS: Lorenz, *Bryologist* 19:25, pl. 2, 1916; Ammons (3.1) 143, fig. B.

EXAMINATIONS: *Conn.* Beacon Falls (Evans) 1907; Glastonbury (Lorenz) 1915; Granly (Lorenz) 1924.—*Ky.* Greenbrier Church in Mullenburg County (Quenby) 1936; Natural Bridge (Taylor) 1925.—*Mass.* Granville (Lorenz) 1911.—*Mich.* Au Train Point (Steere 460) 1933.—*N. C.* Tuckaseegee Falls (Blomquist) 1932; Roan Mt. (Blomquist 58) 1932.—*Ohio.* Darwin in Meigo County (Taylor) 1925; Hocking County (Taylor) 1923; Whites Gulch in Jackson County (Taylor) 1925.—*Wis.* Bark Point in Bayfield County (Conklin 1980) 1923; Superior Bay Point in Superior County (Conklin 1969) 1922.

TYPE LOCALITY: Near Closter, New Jersey (C. F. Austin).

RANGE: *Conn.* (155), *Mass.* (203), *Que.* (50), *Pa.* (338), *Ohio* (504), *Ind.* (2.1), *Mich.* (483), *Wis.*, *W. Va.* (3.1), *Ky.* (218), *Tenn.* (2.1), *N. C.* (43), *N. J.* (22); *B. C.* (508).

The sporophyte is inadequately described. The plant should be thoroughly studied and figured.

We know of no report of the occurrence of this species west of Michigan other than that of Underwood (508) in British Columbia. This throws doubt upon his determination.



8. *Plectocolea hyalina*<sup>148</sup> (Lyell) Mitt., Trans. Linn. Soc. Bot., Ser. 2, 3:198, 1891.

*Jungermannia hyalina* Lyell, in Hook. Brit. Jung. pl. 63, 1816.

*Jungermannia schmideliana* Hueben. Hep. Germ. 99, 1834.

*Jungermannia biformis* Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869): 220, 1870.

*Solenostoma hyalinum* Mitt., Godman in Nat. Hist. Azores 319, 1870.

*Nardia hyalina* Lindb., Bot. Not. 167, 1872.

*Southbya biformis* Aust. Hep. Bor.-Amer. Exsic. No. 26, 1873.

*Aplozia hyalina* Dum. Hep. Eur. 58, 1874.

*Nardia biformis* Lindb., Acta Soc. Sci. Fennica 10:530, 1875.

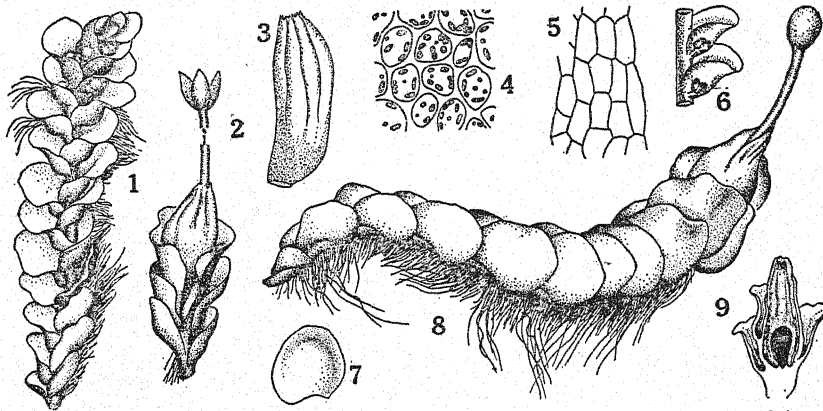
*Southbya hyalina* Husnot, Hep. Gall. 16, 1875.

*Eucalyx hyalinus* Breidl., Mitt. Nat. Ver. Steiermark 30:291, 1894.

*Mesophylla hyalina* Corb., Revue Bryol. 31:13, 1904.

*Haplozia hyalina* Gil Fl. Iberica, Hep. 421, 1919.

Plants in patches, pale green to yellowish green or occasionally purplish, glistening when light in color. Stems up to 15 mm long, prostrate with ascending tips, little to much branched, often reddish on the ventral side. Rhizoids numerous, long, hyaline to usually reddish. Leaves alternate, succubous, somewhat decurrent on the dorsal margin, loosely im-



*Plectocolea hyalina*. 1, Part of a shoot with male inflorescence,  $\times 10.6$ . 2, Dorsal view of tip with sporophyte,  $\times 10.6$ . 3, Perianth,  $\times 12.7$ . 4, Leaf cells,  $\times 185$ . 5, Cells of the perianth,  $\times 93$ . 6, Piece of stem with two male bracts,  $\times 12.7$ . 7, Leaf,  $\times 10.6$ . 8, Lateral view of shoot with sporophyte,  $\times 10.6$ . 9, Longitudinal section of perianth showing union of parts,  $\times 4.8$ . (1-2, 7-8, after K. Mueller; 3, 6, after Pearson; 4, after Meylan; 5, after Jensen; 8, after Macvicar.)

bricate, horizontally spreading on lower part of stem, erect-spreading on upper part, not lobed to hardly 2-lobed, roundish with wide base, concave; apices rounded or some retuse; margin entire but somewhat undulate. Cells of the leaf middle  $25-36 \mu$ , of the margin  $25-30 \mu$ , of the base  $35-43 \mu$ , rounded to oval-hexagonal, subquadrate at margin; walls thin; trigones rather large, distinct; oil bodies 4-10, elliptical, light brown,

<sup>148</sup> hy à lf' nă.

verruculose, about 5  $\mu$  long; cuticle smooth. Underleaves wanting. Plants unisexual. Male plants more slender; male inflorescence terminal; male bracts erect-spreading, imbricate, saccate at base; antheridia 2-3, globose, with a very short stalk. Female bracts larger than the leaves of sterile stems, recurved at apex, the margin entire but undulate. Perianth ovoid, the lower  $\frac{1}{4}$  united with the bracts,  $\frac{2}{5}$ - $\frac{1}{2}$ -emergent, 4-6-plicate above, 1 cell thick above, several cells thick below; mouth with 4-5 crenulations. Seta 1-2 cm long, of 3 concentric rows of cells of about 4, 12, and 20 respectively and the cells of much the same size. Sporangium ovoid-globose, reddish brown, the wall 2 cells thick; epidermal cells with nodular thickenings; inner wall cells with semiannular thickenings. Elaters 8-10  $\mu$  thick, short, rather suddenly attenuate; spirals 2, reddish brown. Spores 14-17  $\mu$ , granular-papillate, brown. Name from *L. hyalus*, glass; the leaves are often yellowish green and let a lot of light through, and thus are more than usually hyaline.—On damp clayey banks and on wet rocks.

ILLUSTRATIONS: Evans, *Rhodora* 21:152, figs. 1-9, 1919; K. Mueller (409) 1: fig. 272; Pearson (433) 2: pl. 158; Hooker (285) pl. 63; Carrington, *Brit. Hep.* pl. 11, fig. 36, 1874-1876; Warnstorf (523) 154, fig. 5; Ekart (124) pl. 6, fig. 45; Macvicar (374) 138, figs. 1-5; Meylan (386) fig. 78; Gil (76) fig. 211; Leitgeb, *Unters. Leberm.* 2: pl. 9, figs. 1-10, 1875; Ammons (3.1) 143, fig. D; Steere (485.5) 76, figs. 1-4; Jensen (323.5) 89, 3 figs.

EXAMINATIONS: *Conn.* Higgins Gorge (Lorenz) 1923.—*Ill.* Peoria (Drexler 1210) 1937; Starved Rock State Park (R. G. Lindeborg, as Drexler 1257) 1937.—*Iowa.* Red Rock in Marion County (Conrad 7, 84) 1937.—*Me.* Jerusalem (Collins 1611) 1896.—*Mich.* Pictured Rocks in Alger County (Steere 492) 1933; Tahquamenon Falls in Luce County (Nichols) 1935.—*N. H.* Madison in Coos County (Evans) 1917.—*N. J.* Deal Beach (Haynes 983) 1905.—*N. C.* Durham (Blomquist 46) 1931; Upper Bunch Creek in Swan County (Blomquist 961) 1932.—*W. Va.* Bretz (Sheldon 4094) 1910.—*Wis.* Bayfield County (Conklin 3030) 1927.

TYPE LOCALITY: British Isles.

RANGE: *Me.* (203), *N. H.* (203), *Vt.* (191), *Mass.* (191), *Conn.* (212), *N. Y.* (191), *Que.* (50), *Pa.* (338), *Ohio* (191), *Ind.* (512.1), *Mich.* (419.1), *Ill.* (246.5), *Wis.* (98), *Iowa*, *Minn.*? (212), *Alta.* (46.2), *B. C.* (50), *Wash.* (216), *Ore.* (246.7), *Cal.* (2.1), *Ariz.* (2.1), *N. Mex.* (272), *Tex.* (2.1), *Colo.*? (51), *Mo.* (191), *Ala.* (191), *N. C.* (43), *Ky.* (218), *W. Va.* (3.1), *Md.*? (212), *D. C.*? (282), *N. J.* (506); *Mex.* (2.1); *S. Amer.*? (212); *Asia* (191); *Eur.* (524.4); *Canary Isls.* (226); *Madeira* (56.58); *Azores* (491); *Africa* (191).

*Plectocolea hyalina* is urgently in need of study from the standpoint of variations and their importance. The question of what is typical and what is not, and what material of the atypical if any should be considered other species, makes reports of the occurrence of the species doubtful in a number of states and countries. These have been indicated by a "?" in the range. There is a good discussion by Evans, *Rhodora* 21:149-159, 1919.

